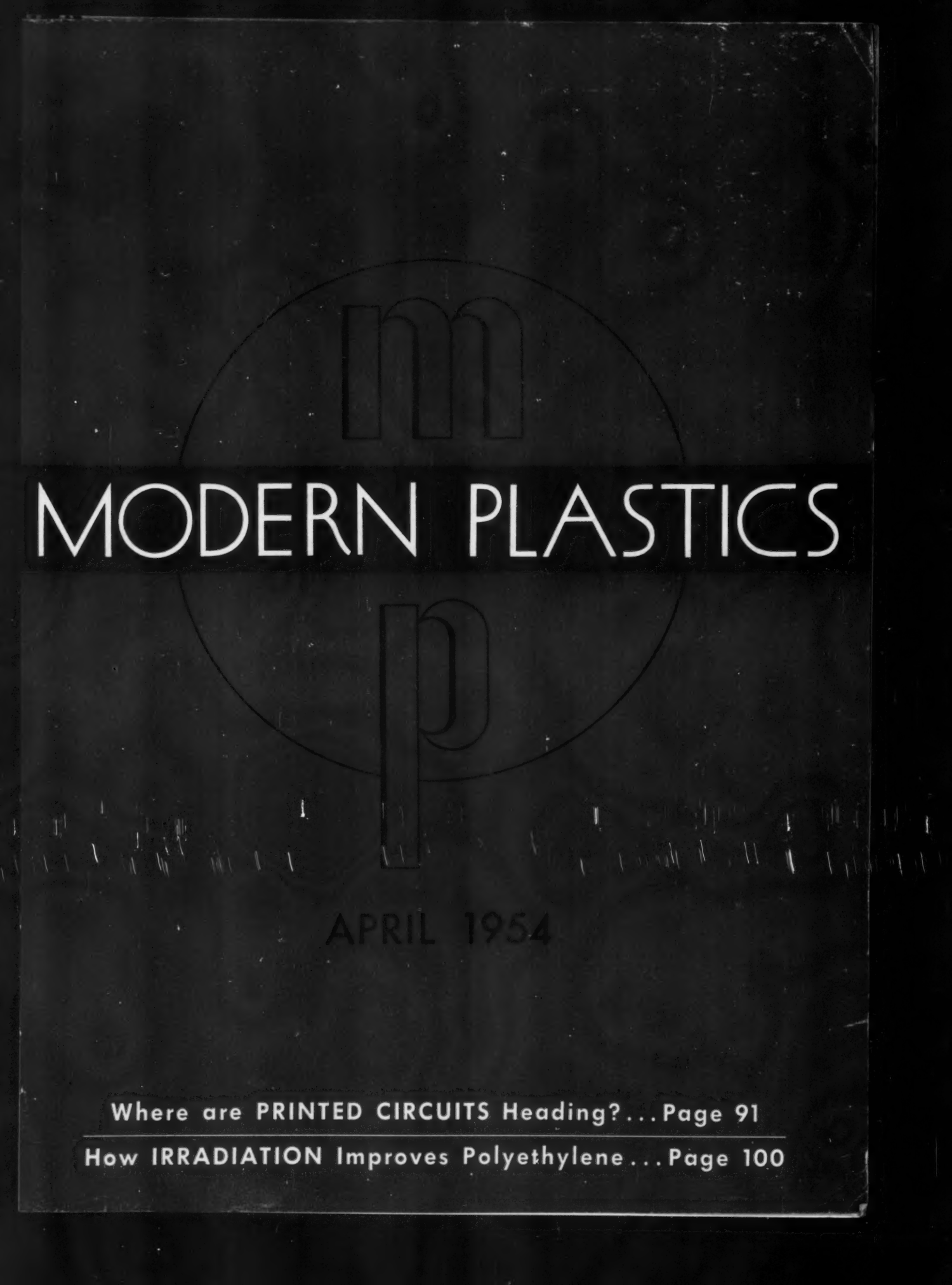
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APRIL 1954
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1948

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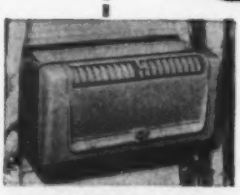

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MODERN PLASTICS*

April 1954 • Vol. 31, No. 8

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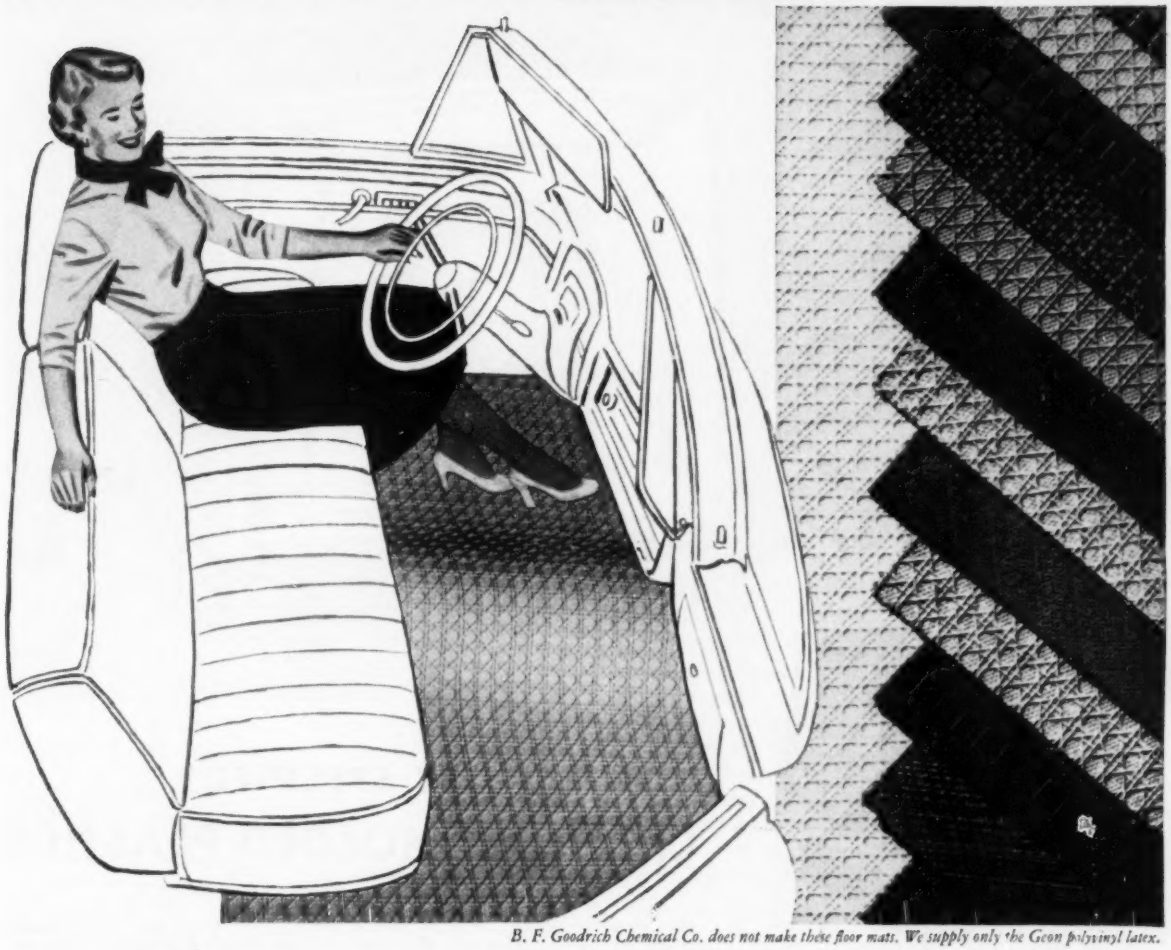

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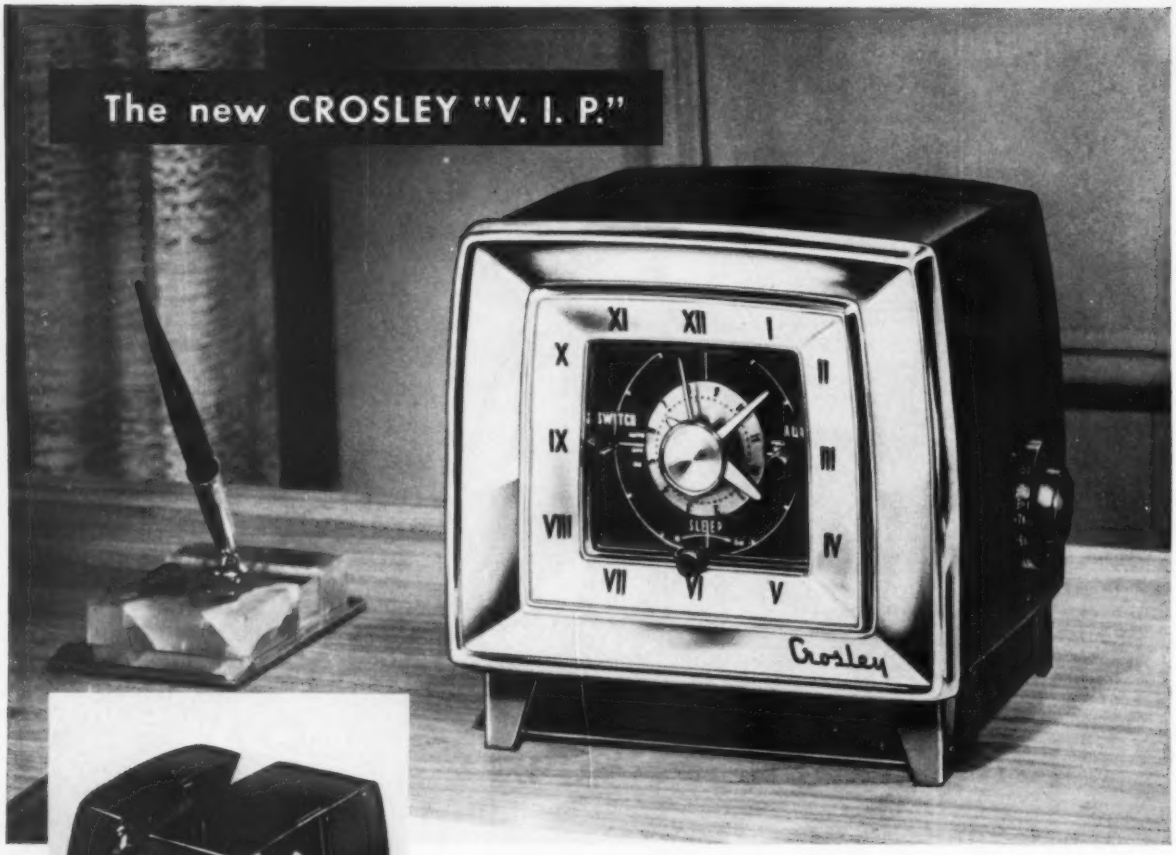

The three matching plastic parts that make up the complete housing.

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EDITORIAL

Plastics Industry Principles

The presidents of four powerful associations concerned with the production and distribution of plastics materials, parts, and products have placed their signatures on a quietly-worded document of great importance.

The men who signed are the presidents of Manufacturing Chemists' Association, Inc., The Society of the Plastics Industry, Inc., The Society of Plastics Engineers, Inc., and Plastic Coatings and Film Association. The document they endorsed is a "Statement Of Principles By The Plastics Industry." A news article on the related program and a reproduction of the official document will be found in our "Plastiscope" section on page 240.

Here is no government-sponsored "code of ethics or behavior," difficult to promote and more difficult to police. Here is no set of selfish "rules," developed for vertical interest. Here is simply a plain statement of purposes and principles to which any material maker, molder, extruder, laminator, or other processor already must subscribe in his heart — if he is cognizant of the relationship between his own operations and the welfare of the plastics industry as a whole. Here is a document that, on the part of management at processor level, is easy to sign, yet requires stability of intention and considerable intestinal fortitude to live up to.

With the tremendous variety of specifically propertied plastics materials on the market today, and with our present knowledge of design for plastics, there is no excuse whatever for misapplication of plastics. True, new materials must be played around with before their position in the over-all picture can be established, but the too-frequent promotion of an application based on insufficient field research and too few use tests can do great damage. If each and every man who, as an entrepreneur, endorses this document, lives up to the principles outlined, much good will be done. The sad fact is that a single misapplication or a single bad design in a single material to be sold to a single market can reflect on the integrity of the whole industry and on the quality of products in thousands of categories made from scores of plastics materials.

We hope every company will sign. We hope each man who signs will carefully read the document before signing. And we're sure that a better total plastics industry will result.

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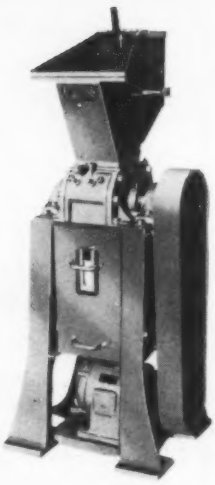
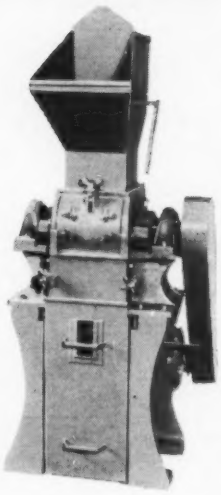
MIDGET: Capacities up to 75 pounds an hour. Has 5½"x 6" throat opening and new hopper design which prevents fly-back leakage. Takes only 18"x 22" floorspace. Powered by 1 H.P. motor. Handles gates, sprues, runners, etc. from 1/8" to ½" sectional thickness.



MIDGET

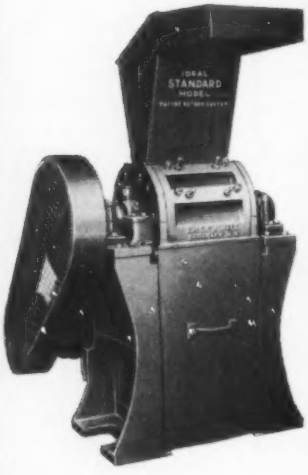
LABORATORY 251: Capacities up to 150 pounds an hour. 8"x8" throat opening. New hopper design prevents fly-back leakage. Two models—to feed into bin or directly into a drum. 1½ or 2 H. P. motor. Takes gates, sprues, runners and small rejects.



LABORATORY 251

CHOOSE FROM THESE B & J GRANULATORS

STANDARD IDEAL: Capacities up to 250 pounds an hour, only 27"x 36" floor space. Features large 3½"x 10" or 6"x10" throat opening. 2 or 3 H.P. motor. Perfect for beside-the-press grinding and for accumulated gates, sprues, runners, and medium area rejects.



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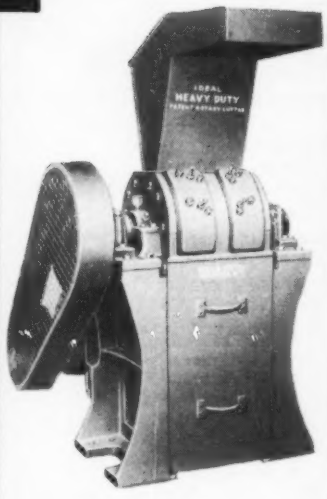

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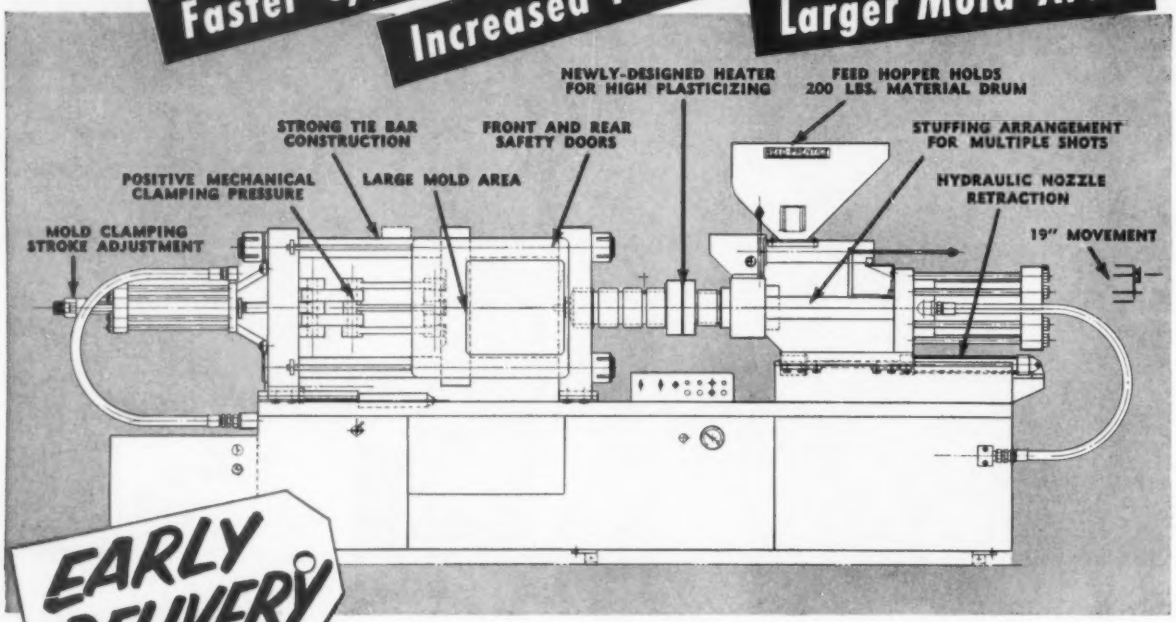
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Minimum die space	8"	7"
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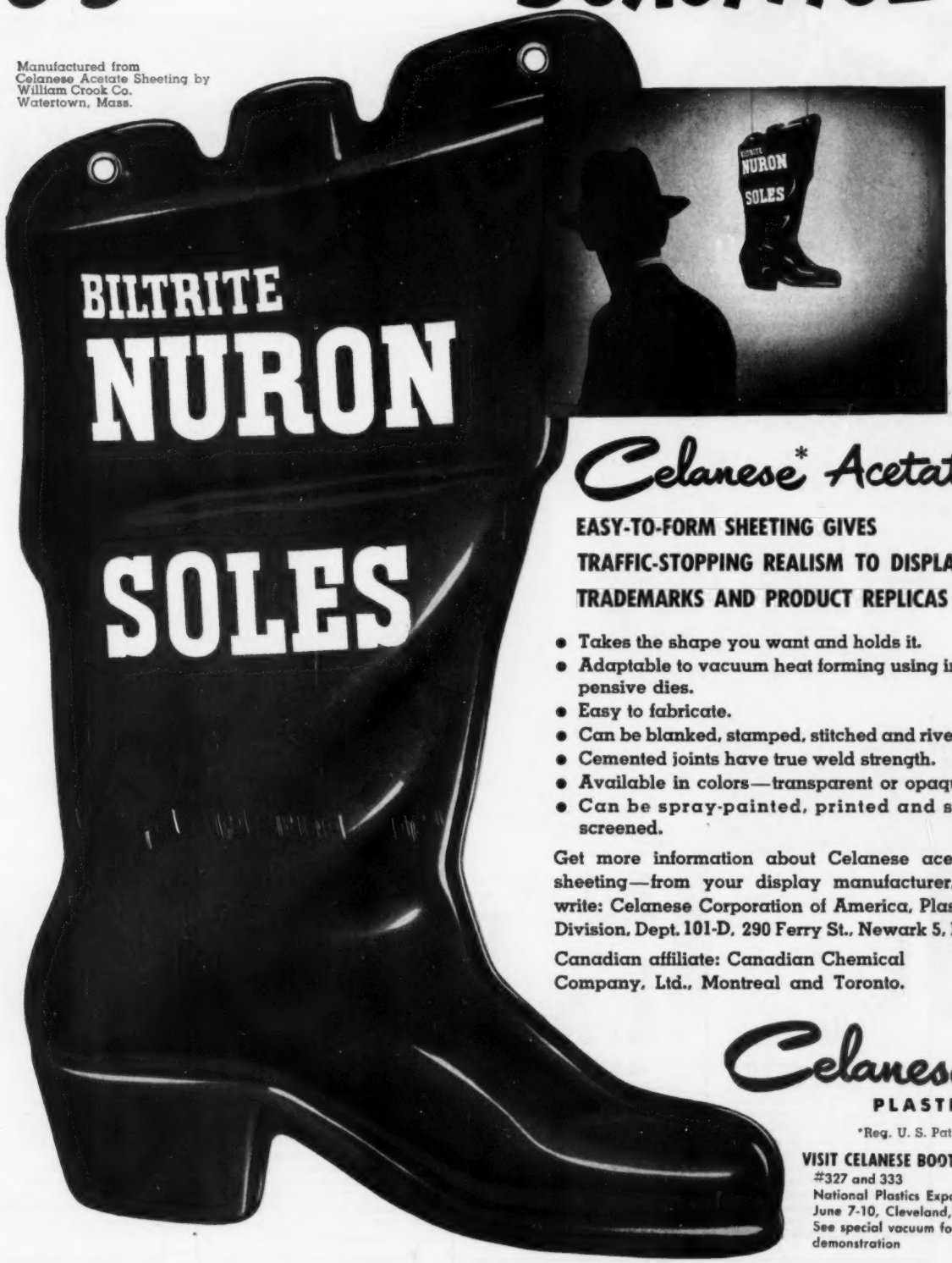

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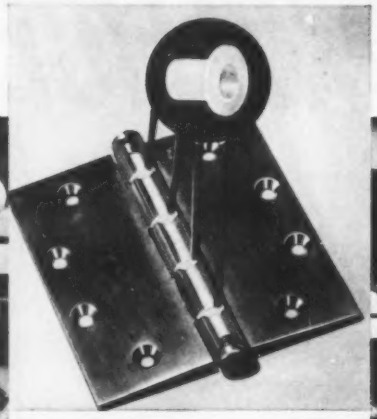
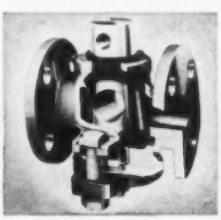


CUTAWAY VIEW of heavy-duty hinge showing bearings of Du Pont nylon. These bearings are just one example of how parts molded of Du Pont nylon are helping industry set new standards of efficiency and economy. Hinge manufactured by H. S. Getty & Co., Inc. Bearings molded by H. M. S. Associates.

DU PONT NYLON is the most versatile plastic material for mechanical applications. Parts made of it are lightweight but unusually strong, resilient, have excellent bearing characteristics, often require little or no lubrication. They can be economically mass-produced by injection molding or extrusion. A typical application is this automatic fare-box gear.

ALATHON* polyethylene resin is readily processed by molders and extruders of plastic materials. It has good chemical resistance and excellent dielectric properties. Its toughness and flexibility over a wide range of temperatures and freedom from odor, taste and toxicity make it ideal for packaging. A drum liner for packaging chemicals is shown.



TEFLON* tetrafluoroethylene resin has no peer among plastics for severe service. Very few chemicals attack it. It has been used where temperatures reach 500°F. Its outstanding dielectric properties make it ideal for electronic applications. "Teflon" is formed by special molding processes or extrusion. A component for a plug valve is shown.

LUCITE* acrylic resin is used to make products that are both functional and decorative. The most beautiful of all plastic materials—it can be clear and transparent or produced in color. Products of "Lucite" are shatter-resistant, have good dimensional stability and possess excellent resistance to weathering. A colorful automobile medallion is shown.

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Have you and your company investigated the properties of Du Pont nylon and the other members of the Du Pont family of plastic engineering materials—"Alathon" polyethylene resin, "Lucite" acrylic resin and "Teflon" tetrafluoroethylene resin? The application described above and others shown on these pages are typical of the product improvements made possible when design and service requirements are evaluated in terms of the properties of these unique engineering materials.

For further information on the properties and uses of these materials, use the coupon below or write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 304, Du Pont Bldg., Wilmington 98, Delaware.

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Please send me more information on the Du Pont plastic engineering materials checked: ☐ Du Pont nylon; ☐ "Alathon" polyethylene resin; ☐ "Teflon" tetrafluoroethylene resin; ☐ "Lucite" acrylic resin. I am interested in evaluating these materials

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*Name*_____

*Title*_____

*Firm Name*_____

*Street Address*_____

*City*_____

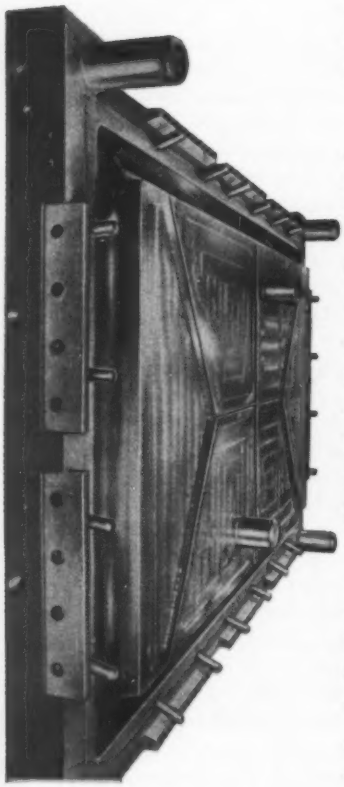
*State*_____

*Type of Business*_____

here's why

CRUCIBLE MOLD STEEL ***was chosen for largest injection mold...***

Crucible CSM 2 mold steel was the choice for this injection mold — the largest yet produced. From it, the Cambridge-Panelyte Molded Plastics Company, a subsidiary of St. Regis Paper Company, turns out trim frames for Carrier home freezers. The mold itself was made by Eagle Tool and Machine Company.



There are good reasons why leading manufacturers specify Crucible. First of all, Crucible mold steels are actually tool steels, made by the electric-furnace process to tool steel standards . . . in the country's leading tool steel mill. It's this painstaking care that pays off in uniform, high-quality steels.

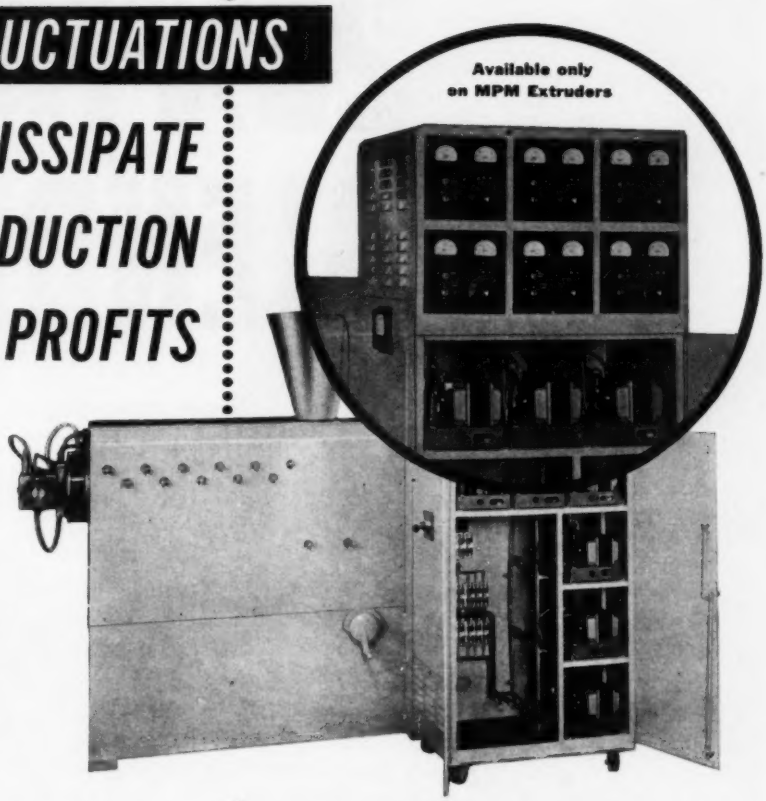
It will pay you to specify Crucible mold steel for your next job. Crucible engineers are available to work right with you on the selection or fabrication of mold steels . . . and when you choose the correct grade you can get it *fast* from your local Crucible warehouse.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **MOLD STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

NEW DEVICE ENDS HEAT FLUCTUATIONS THAT DISSIPATE EXTRUSION PRODUCTION AND PROFITS



MPM "Electronic Brain" Heat Controllers eliminate temperature as a variable in the extrusion of sheeting, film, tubing, wire, monofilaments, other sections.

MPM "Electronic Brain" Heat Controllers lick, once and for all, the problem of variations from required temperatures during all phases of extrusion operations. They replace outdated "on-off" and proportioning regulating devices with stepless continuous temperature regulation of unrivalled accuracy. Their electronic compensation circuits are rugged—virtually immune to common industrial hazards which influence the accuracy of other heat controls.

HOW MPM "ELECTRONIC BRAIN" HEAT CONTROLLERS WORK

FIRST **Highly responsive heat sensing elements located in critical positions relay slightest temperature variations to "Electronic Brain."**

SECOND **"Electronic Brain" circuits automatically decide precise amount of heat increase or decrease needed to hold desired temperature, and transmits information to heating device.**

THIRD **Heat measuring device instantaneously regulates heat input. All three operations occur simultaneously. The "Electronic Brain" compensates for many factors affecting temperature such as frictional heat and forced cooling.**

MPM Heat Controllers upgrade MPM extruders to a point where their over-all superiority is beyond challenge. Full details about MPM extruders in all sizes—for any extrusion job—will be sent on request.

THESE EXCLUSIVE MPM ADVANTAGES MEAN INCREASED EXTRUSION PROFITS

Precision control: The instruments supply *exactly* the right heat for a specific application. No relays, switches, valves, contacts, motors or photocells complicate the operation. The pre-set temperature is never over-ridden.

Higher production: Set-up time is shortened. Scrap losses are reduced to a fraction of what previously has been accepted as normal. With temperature variations practically eliminated, better tolerance than ever before is achieved.

Lower costs: MPM Heat Controllers pare electric consumption. Since they permit such accurate tolerance control, they reduce unnecessary "give-away" of resins. For instance, they eliminate the need for adding a "safety factor" to make certain specifications are met.

modern plastic machinery corp. mpm

15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

West Coast Representative 4113 West Jefferson St., Los Angeles 16, Calif.

25% FASTER CALENDERING

of heavy vinyl sheeting with PLIOVIC

So reads the report on Textileather Corporation, manufacturers of Tolex a new "plastic leathercloth" especially designed for use in coats, jackets and sportswear—and of other high quality, fabric-backed, heavy-gauge vinyl sheeting.

Using PLIOVIC – Goodyear's easier processing polyvinyl chloride resin – Textileather found they could operate their calenders at speeds up to 25% higher than those possible with any other resin tried. And they had no problem with the streaking, roughening or loss of gloss usually encountered in the finished sheet at such speeds.

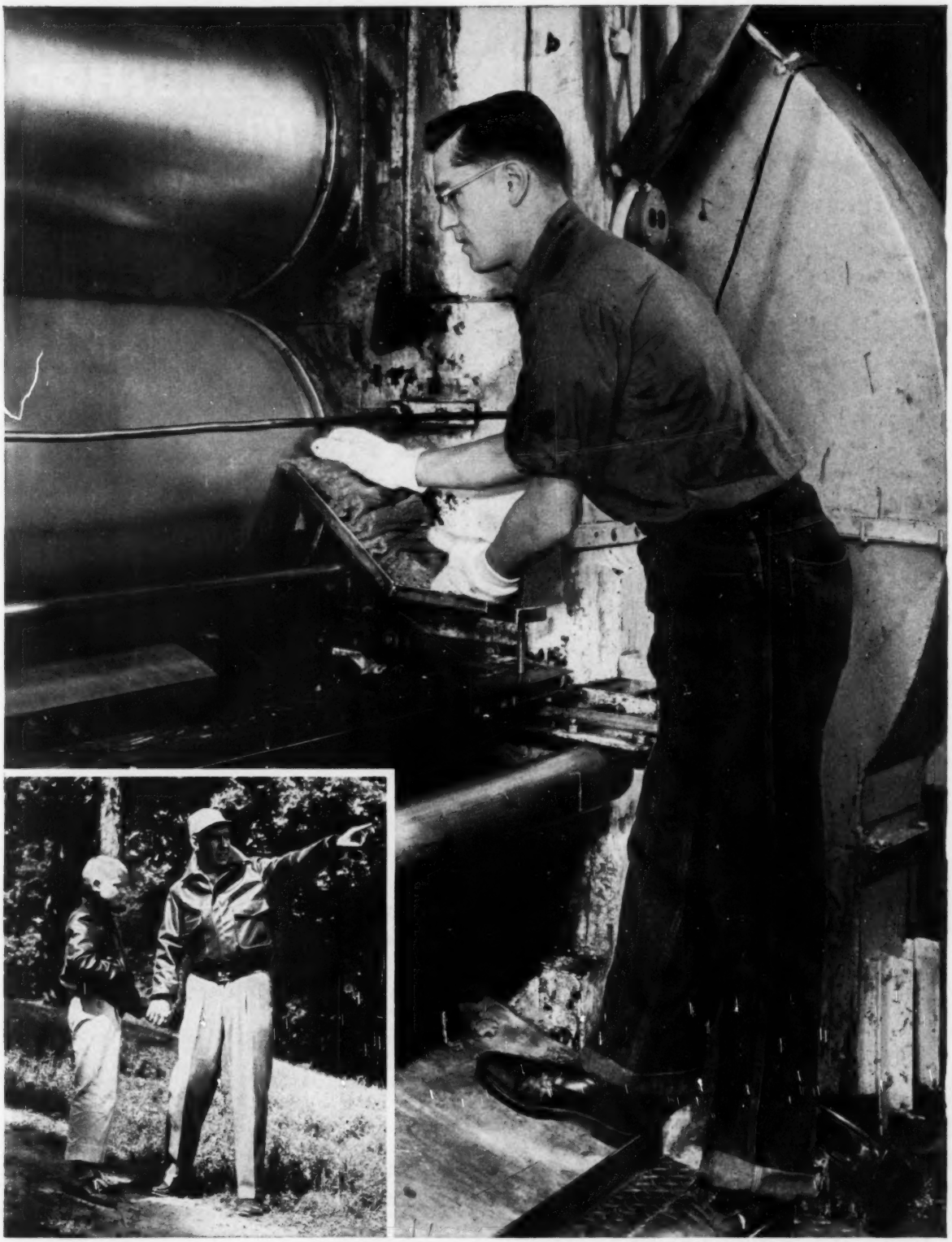
Two other advantages gained with PLIOVIC were the elimination of "fish-eyes"—hard agglomerates of unfused particles—in the sheet and the use of larger batches in the Banbury. All these added up to more throughput at lower cost, but at the same high level of quality.

Reason for this improved production with PLIOVIC is the fact that its polymerization is carefully controlled to give a particle size, shape and distribution, providing high bulk density and fast fluxing, combined with maximum physical properties.

PLIOVIC has proved itself in many plants. It can in yours. Just give it the chance. Get samples, the new technical manual and complete help, by writing to: Goodyear, Chemical Division, Akron 16, Ohio.

CHEMICAL GOODYEAR DIVISION

Use-Proved Products—CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS—The Finest Chemicals for Industry



TOLEX MAKES these jackets soft, pliable, waterproof and highly resistant to scuffing or abrasion. PLIOVIC permits this fabric-reinforced sheeting to be calendered faster and at lower cost.

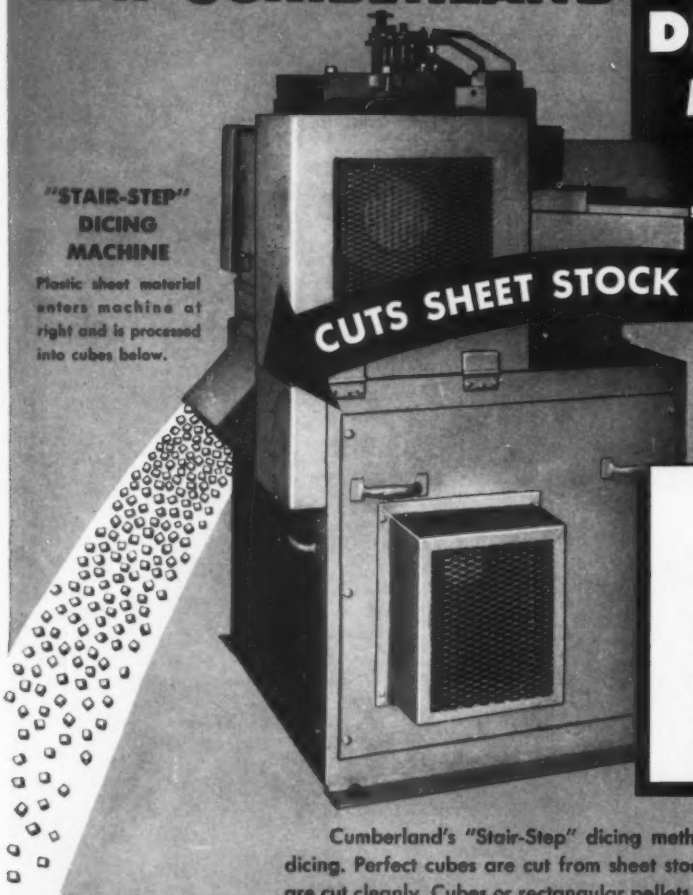
Tolex T. M. Textileather Corporation, Toledo, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

NEW CUMBERLAND "STAIR-STEP" DICING METHOD

Dices FULL RANGE of Plastic Materials!



"STAIR-STEP" DICING MACHINE

Plastic sheet material enters machine at right and is processed into cubes below.

CUTS SHEET STOCK INTO UNIFORM CUBES!

Now You Can Choose From TWO Cumberland Dicing Methods

NEW "STAIR-STEP" METHOD is the "universal" dicing method. It dices the *full range* of plastic materials having widely varying physical properties.

WELL-KNOWN "NOTCHED-KNIFE" METHOD dices vinyl materials of medium plasticizer content, vinylidene chloride, and other materials having suitable physical properties.

NOTCHED-KNIFE DICING MACHINE

Cumberland's "Stair-Step" dicing method offers you a *completely* new method of dicing. Perfect cubes are cut from sheet stock in one shearing action! All sides of cubes are cut cleanly. Cubes or rectangular pellets may be produced in various sizes (⅛" to ½") by simply changing knives.

WRITE FOR COMPLETE INFORMATION!

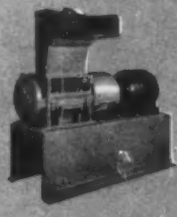
This new dicing principle makes it possible to dice the *full range* of plastic materials, including polyethylene, vinyl, acetate, and nylon. Two standard machine sizes accommodate sheets up to 7" or 14" wide. Machines to handle greater widths specially built.

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

Designed Specifically for Plastics . . . . To Give You Maximum Operating Efficiency and Economy

GRANULATING MACHINES (All Models)

Eight different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.



20" ALL-STEEL GRANULATOR

Rugged machine for granulating large "difficult-to-process" plastic parts. Eliminates prior band-sawing. 8" x 20" throat opening.

PREBREAKER

Cuts up refrigerator panels, radio, television cabinets, polyethylene bottles and containers. Available with 20" x 32" or 10" x 24" throat opening.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. T · BOX 216 · PROVIDENCE · RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 West Jefferson Blvd., Los Angeles 16, Cal.

See us at the National Plastics Exposition, Cleveland, Ohio, June 7-10th 562.

MEMO: To our Advertising Agency
SUBJECT: Could those ads be about us?

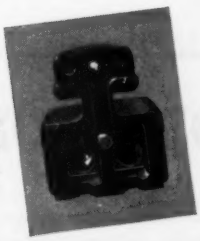
Let's face it, fellows! Haven't you been gilding us lilies a bit?

We sweat bullets, sometimes, over moulds. Sometimes we balance off imponderables like material variations, temperature changes, atmospheric conditions and the rest—and get the right answer quick. Sometimes, not so quick. For this moulding business is still almost as much art as science, and there isn't any such thing as heavy-duty, all-weather, push-button perfection.

Admittedly, good equipment and experience like ours means a break for the customer. Which probably explains why we have on our books right now hundreds of customers, big and small, who've stuck with us as principal suppliers for ten years and over.

How about using that fact for an ad —instead of a picture of a plastics application which "Only could be properly produced by K-K, with its mighty resources and unparalleled know-how"?

Try it. Let's see if one or two good new customers don't call us!



Twist-out plug moulded for Bulldog Electric Products —a 10-year-plus K-K customer

KURZ-KASCH

Specialists in Thermo-Setting Plastics for 37 years

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, *Mt. Vernon MO 4-4866* • Rochester, *Hillside 4352* • Chicago, *Merrimac 7-1830* • Detroit, *Trinity 3-8200* • Philadelphia, *Hilltop 6-6472* • Dallas, *Logan 5234* • Los Angeles, *Richmond 7-5381* • St. Louis, *Delmar 9577* • Atlanta, *Elgin 0870* • Toronto, *Riverdale 3511*.

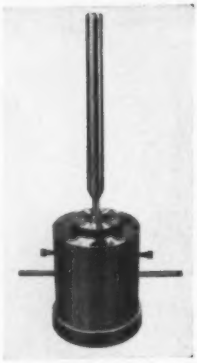
EXPORT OFFICE: 89 Broad St., New York City, *Bowling Green 9-7751*.

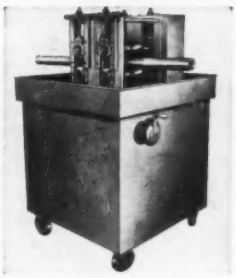
ROBBINS

EXTRUSION EQUIPMENT FOR PLASTIC PIPE

POLYETHYLENE PIPE DIES

- Diameters from ½" to 6" inclusive
- Choice of water or air cooled mandrels



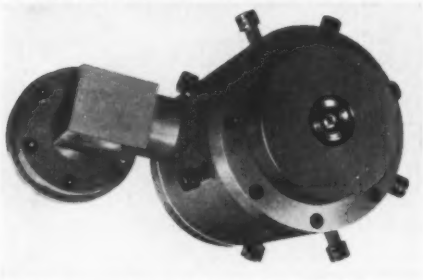


PIPE PULL-OFF UNIT

This unit is adjustable to handle pipe from ½" to 6" diameter. Dual rollers prevent slippage. The bottom roller runs in a water bath to insure proper cooling. The height of the take-off is adjustable from 36" to 44".

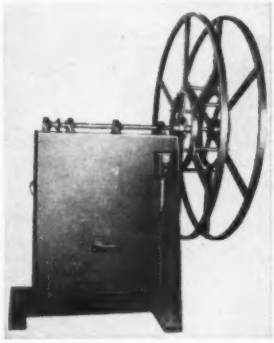
- Convertible to a capstan by merely changing rollers
- Supplied complete with U. S. Varidrive motor and switch

OFFSET TYPE DIES FOR BUTYRATE OR POLYSTYRENE



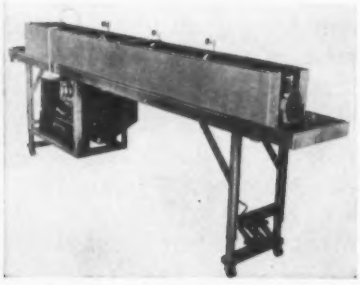
- Diameters from ½" to 6" inclusive

PIPE COILING MACHINE



Here is a Robbins designed and built unit which meets the requirements of many producers. Quickly and efficiently, it makes a neat coil of any pipe from ½" to 3". Basic equipment includes 3 small reels and 2 large reels which can be changed in a matter of seconds.

- Powered with a U. S. Varidrive motor



REFRIGERATED WATER TANK

Experience has proven this Robbins unit to be highly efficient in helping maintain accurate control of pipe dimensions.

- Equipped with slots for sizing rings
- Sizing ring holders and sizing rings optional
- Adjustable height
- Mounted on ball bearing casters

PLASTIC EXTRUSION DIES A SPECIALTY

- Prices furnished on request for rigid vinyl pipe dies
- All sizes of inside and outside cooling rings furnished from stock
- Robbins designs and builds special pipe dies for all materials, in sizes from .187" to 12" O.D.
- Cutting equipment designed and built to customer specification

ROBBINS TOOL & DIE CO.

1430 Mishawaka Elkhart, Indiana

New Servel "Automatic Ice-Maker" gas and electric refrigerators feature handles that can be operated by wrist or elbow. Colorful handle-facings, 7½" x 4" x 1½", are molded of PLEXIGLAS V-100.

...It's a one-piece molding of

PLEXIGLAS

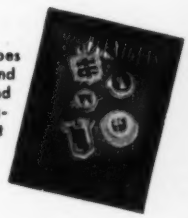
The handsome face of this refrigerator handle is not an assembly of separate parts. The raised edges, the sides, lettering, markings, and background areas are all part of the same single molding—of PLEXIGLAS acrylic plastic.

The molding is transparent—metallized and spray painted on the rear surface to produce the brilliant chrome bezel effect, the mirrored and richly colored backgrounds, the gleaming letters and decorations.

In addition to eye-catching appearance, the part has excellent serviceability. Because it is molded of PLEXIGLAS, its crystal clarity does not change with age . . . and it has the strength and stability to withstand hard knocks, sudden shocks, moisture, and constant handling.

The chances are that parts molded of PLEXIGLAS can add durable sales appeal to the product *you* are designing or manufacturing, too. We will be glad to tell you how this acrylic plastic, so widely used in many fields, can meet your specific requirements.

This booklet, "PLEXIGLAS Molding Powders", describes the properties and advantages of PLEXIGLAS and shows how it is being used for molded parts and extruded sections in outdoor and indoor applications. Write to the Plastics Department for it today. You will receive it promptly.



CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

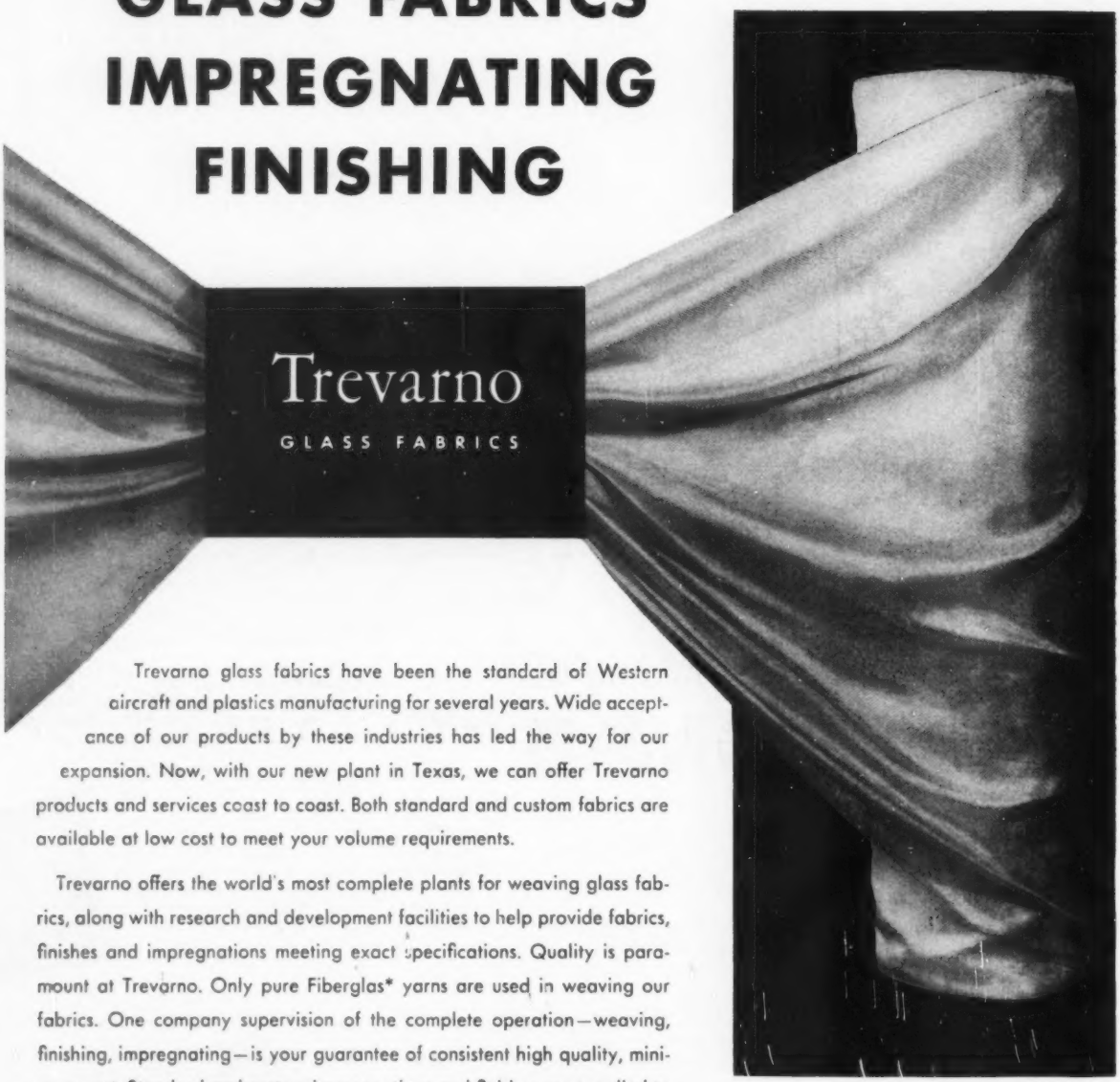
Representatives in principal foreign countries

PLEXIGLAS molding powders are listed in Sweet's product Design File, Section 1c/PL
PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off. and in principal countries of the western hemisphere
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada*

Now! Coast to Coast—TREVARNO!

A leading supplier of quality

GLASS FABRICS
IMPREGNATING
FINISHING



Trevarno glass fabrics have been the standard of Western aircraft and plastics manufacturing for several years. Wide acceptance of our products by these industries has led the way for our expansion. Now, with our new plant in Texas, we can offer Trevarno products and services coast to coast. Both standard and custom fabrics are available at low cost to meet your volume requirements.

Trevarno offers the world's most complete plants for weaving glass fabrics, along with research and development facilities to help provide fabrics, finishes and impregnations meeting exact specifications. Quality is paramount at Trevarno. Only pure Fiberglas* yarns are used in weaving our fabrics. One company supervision of the complete operation—weaving, finishing, impregnating—is your guarantee of consistent high quality, minimum cost. Standard and custom impregnations and finishes are supplied to precision specifications; fabrics are woven to your exact requirements.

*T. M. Reg.

Write for information on your specific problems; or request our catalog.

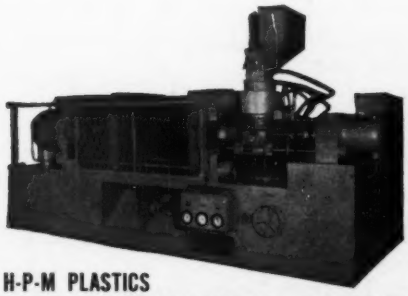
COAST MANUFACTURING & SUPPLY CO.
BOX 71M · LIVERMORE · CALIFORNIA
Since 1867

Plants at
LIVERMORE, CALIFORNIA
SEGUIN, TEXAS

H-P-M PREPLASTICIZER DOES IT BEST!

. . . and faster, too! Steering wheel production at U. S. Rubber is really in high gear and H-P-M preplasticizers are doing the job! Yes, the H-P-M "48" has proved itself at the U. S. Rubber Co. . . . a repeat order just added another machine to their line.

Here's one more tough molding job which versatile H-P-M preplasticizing machines have solved. Have you investigated this low cost H-P-M 48 oz. injection molding machine and how it can profitably work for you? Do so . . . today!



H-P-M PLASTICS
INJECTION MOLDING MACHINES—9 to 400 ozs.

HPM

THE HYDRAULIC PRESS MFG. CO.

Presses For Every Pressure Processing Application

Now! Electronic Welding of plastics

a faster *AUTOMATIC* operation with the *New*

Thermatron TURNTABLE

Latest unit in THERMATRON's expanding line of electronic heat sealing machinery for vinyl plastics is this new turntable with an indexing arrangement which makes possible *automatic operation* of *any* THERMATRON press and generator! It not only speeds up production, but is unusually simple to operate, reduces actual labor, and guarantees uniformity of product.

A number of loading trays are spaced around the outer edge of the table. When the items to be sealed are loaded in the trays the table rotates into position and the press closes and seals automatically. Entire operation is controlled by an electric timer insuring accuracy . . . And speed can be set to the fastest operator's pace. With less handling of the unit to be sealed the safety factor is increased and the operator is free to achieve a higher output.

Turntable is available in sizes up to 60" in diameter – adjustable for 4, 6, 8, 12 and 24 indexes per revolution. A maximum of 30 seals per minute is possible.

Radio Receptor engineers will gladly give you further details on the new Thermatron Turntable Model T-T-2. Write or telephone us today for your copy of bulletin no. 82

THERMATRON DIVISION

RADIO RECEPTOR COMPANY, INC.

In Radio and Electronics Since 1922

SALES DEPARTMENT: 251 WEST 19TH STREET, NEW YORK 11, N. Y.

Chicago: 2753 West North Avenue

Los Angeles: Electroseal Plastics Co., 130 North Juanita Avenue

Factories in Brooklyn, N. Y.

The Ass in the Lion's Skin

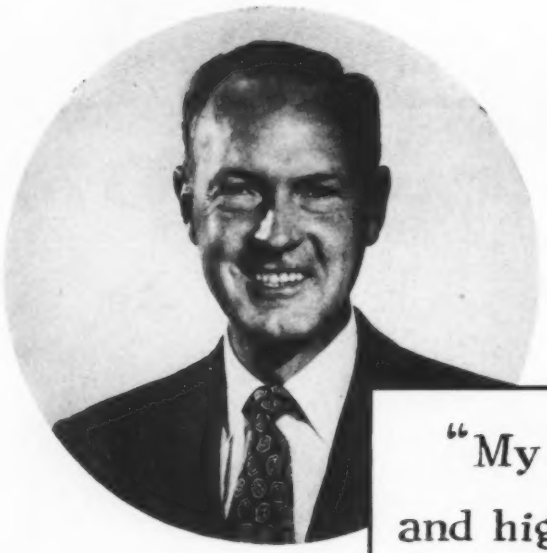
An Ass, finding the skin of a Lion, put it on and roamed about frightening all the silly animals he met. Seeing a Fox, he tried to alarm him also, but the Fox, having heard his voice before, said: "Well, to be sure! And I should have been frightened too, if I had not heard you bray."—*Aesop*

They who assume a character that does not belong to them generally betray themselves by overacting.

At Plenco, we do not pretend to perform miracles, but you can rely on our proven ability to continuously produce quality controlled phenolics for almost every application.

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS



"My need for close tolerance and high production decided me on Bipel auto-control presses"

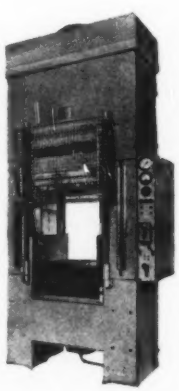
■ Their outstanding production ability and tolerance control when small multi-cavity moldings are involved have clinched many a sale for Bipel down-stroking prefiller presses. Bipel presses show their superiority to best advantage on jobs where cure is short and open press time for stripping, reloading and setting inserts is comparatively long.

On jobs like these, Bipels' extremely fast clamp and transfer yield definite production premiums over conventional press equipment. What's more, the Bipel "auto-control" takes the task of running the cycle out of the operator's hands. Once this mechanism is set, it recreates even the most complicated molding cycle with obsolute uniformity. The results? *Virtual elimination of rejects and materially improved tolerance control.*

BIPEL DRIVES A single central power unit provides inexpensive, trouble-free *medium* pressure to as many as twelve Bipel presses through a unique line feed system. At the press, this pressure is used direct from the line (1:1), or doubled (2:1), or tripled (3:1) at will . . . giving a choice of three working pressures per press!

ECONOMICAL OPERATION Installations of Bipel presses are neat, uncluttered by piping, and extremely compact. For single press operation, a miniature drive unit is built within the press frame. The low cost of installation, operation and maintenance is reflected in lower cost for each individual piece molded.

Bipel presses offer intriguing opportunities to any molder who wants to maintain fine tolerances, increase production, and reduce his costs at the same time. Send today for full details.



Type 40	Type 100	Type 200
20, 40 or 60 tons	50, 100 or 150 tons	100, 200 or 300 tons

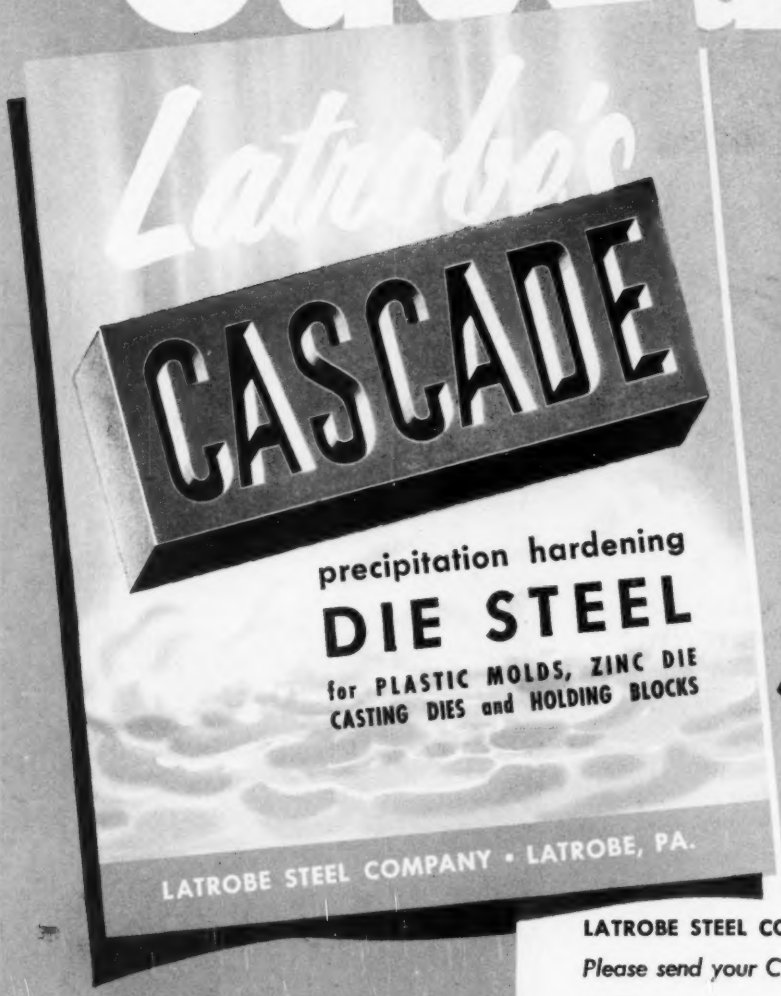
American inquiries should be sent to
Ralph B. Symons
Associates, Inc.
3571 Main Road
Tiverton,
Rhode Island

B·I·P GROUP

B. I. P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

Cascade



for BETTER PLASTIC MOLDS

send for this booklet today

LATROBE STEEL CO., Latrobe, Pa.

Please send your CASCADE Bulletin to:

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FIRM NAME _____

POSITION _____

ADDRESS _____

CITY _____ STATE _____

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Boston Buffalo Chicago Cleveland Dayton
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LATROBE STEEL COMPANY
LATROBE, PA.

LET US TAKE OVER YOUR PLASTICS PARTS PRODUCTION

Here at Quinn-Berry you will find every production facility necessary to produce your plastics components profitably. Turn your plastics parts production over to Quinn-Berry. Here you see three views of the newly redesigned plant—a portion of the engineering department where parts and molds are designed, a section of the large machine shop where we make our own molds, and a view of the press room. You can benefit from our wide experience in designing and producing parts for nearly every industry.

The next time you need plastics parts, bring your problems to Quinn-Berry. You will find that we can make your production job easier.

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James L. Fitzsimmons
39 Lackawanna Plaza
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Bloomfield 2-1040

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QUINN-BERRY

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PLASTICS

MOLDERS OF ALL TYPES OF THERMOPLASTIC MATERIALS

hercocel®

FOR PRODUCTS ON THE MOVE

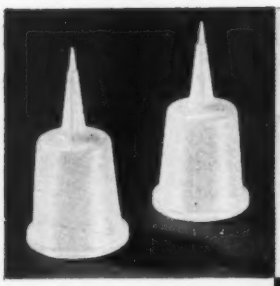
Designed with Hercocel, products move into new markets handsomely styled, functionally sound, and attractively priced. A fine example is the new Direct-A-Call telephone, an all-plastic unit made up of nine different parts precision-molded with Hercocel A. Richly colorful and featherlight, it's ruggedly tough and shatterproof, built for long-term service.

Direct-A-Call telephone parts molded by Watertown Mfg. Company and Cowan & Boyden Corporation for Connecticut Telephone & Electric Corporation, Meriden, Conn.

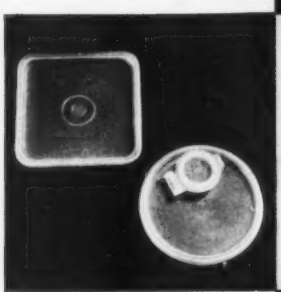
Versatile Hercocel A (cellulose acetate molding powder) is used to mold fast-moving merchandise of many types . . . electrical products, kitchen tools, beads, personal goods and toys. Hercocel can get *your* products on the move . . . in design, production, and sales. For information about the many Hercules services to the plastics industry, write:

Cellulose Products Department
HERCULES POWDER COMPANY INCORPORATED 916 Market Street, Wilmington 99, Del.

CP54-1



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!



Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

TUPPER! TRADE MARK

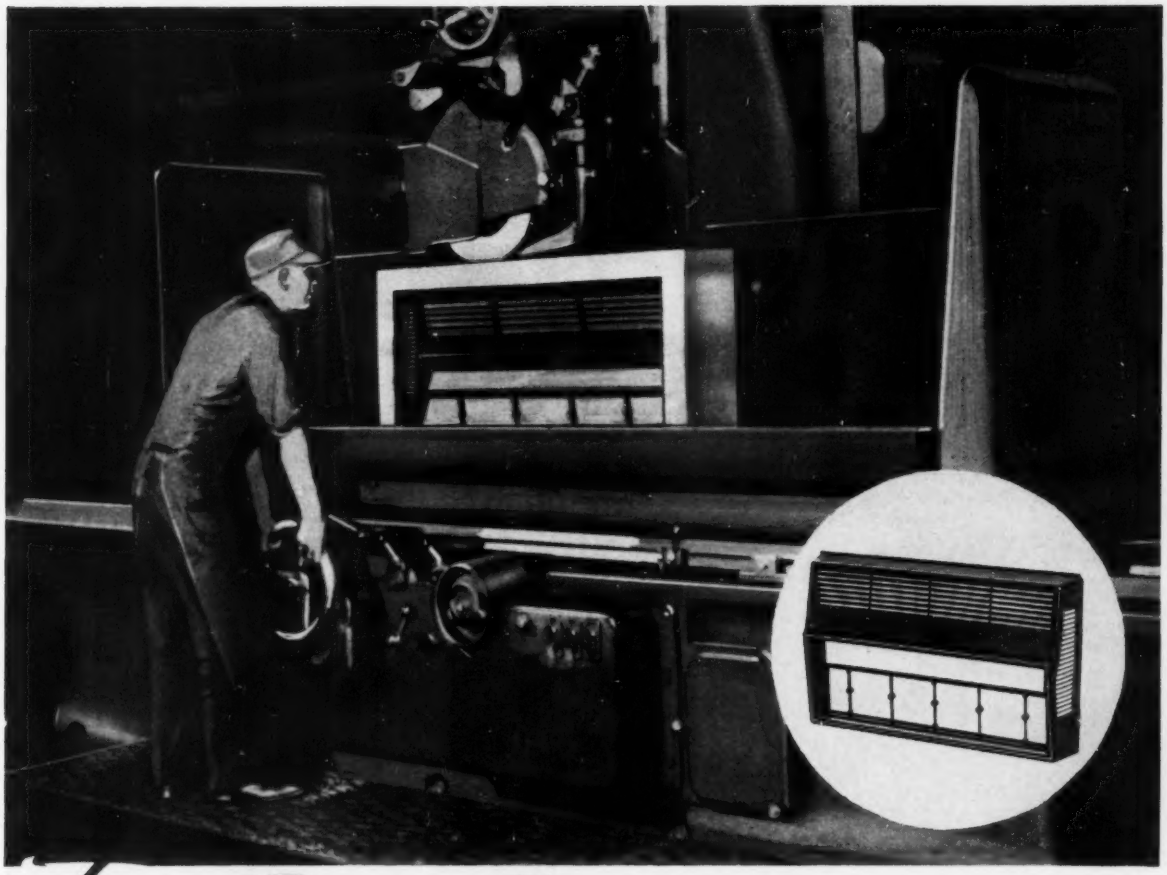
TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices:
Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q.
Showrooms: 225 Fifth Ave., N. Y. C.
Address All Communications To:
DEPARTMENT M-4



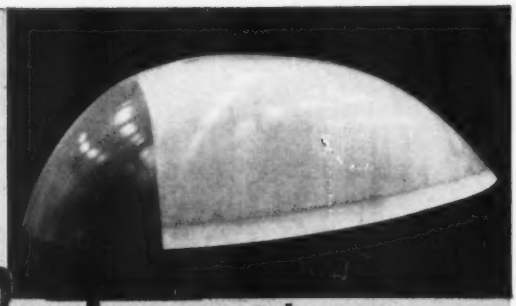
for a Better Product

AT LOWER COST... A PERFECT MOLD

At Newark Die Company skilled craftsmen guide modern machines to fashion molds of superior quality . . . a vital step in making a better molded product at lower cost. Here a giant Mattison surface grinder readies a mold for the ornamental grille of an air conditioner. With unerring precision it squares the mold and smooths the parting surface to a flawless finish . . . one of the many steps in the making of a perfect mold. Into this and every stage of mold-making at the Newark Die Company goes a combination of engineering know-how, proud craftsmanship and unsurpassed facilities . . . a combination that has set mold-making standards for more than thirty years.

NDC TRADE MARK

From Giant Radomes That Protect Electronic Equipment—To Helmets For Construction Workers!



Pittsburgh Selectron Polyester Reinforcing Resins

Now Ready For a Thousand New Uses

PITTSBURGH SELECTRON Resins have opened numerous opportunities for vastly broadened product usefulness with greatly reduced manufacturing costs in many cases.

● **When combined** with suitable fillers—Fiber Glass, cotton, rayon, nylon, felt, sisal, paper, etc.,—SELECTRON Resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

● **Because of such unique** and distinctive advantages, SELECTRON Resins are today being used in a wide range of products. These are as different in size and shape as helmets for construction workers, manufactured by the Automatic Plastic Molding Company, of Berkeley, Calif., for the E. D. Bullard Company, of San Francisco, and giant radomes that protect electronic equipment in aircraft, produced by several large makers.

● **SELECTRON Resins** are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fillers for casting, potting and impregnating.

● **Because of their** unusual utility, more and more manufacturers are probing the seemingly endless possibilities of SELECTRON Resins. If you are designing a new product, or redesigning one you are now making, SELECTRON may help you make it lighter, stronger, more durable and, possibly, at lower cost. Call on us for *free* advisory service. We may be able to save you time and money.

Send For FREE Booklet!

● Write, wire or phone today for our new booklet containing description of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, 2000 Grant Building, Pittsburgh 19, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Helmets
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

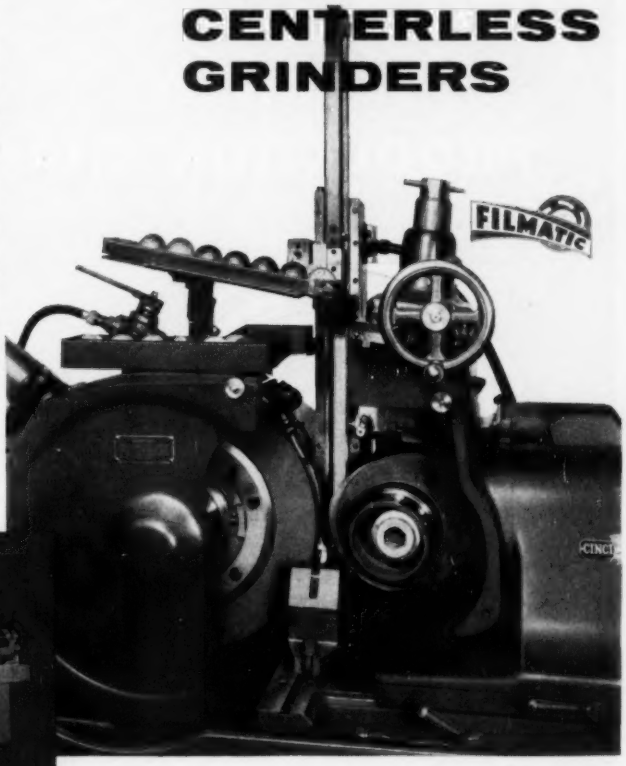
PITTSBURGH PLATE GLASS COMPANY

Plastic and other Non-Metallic Parts

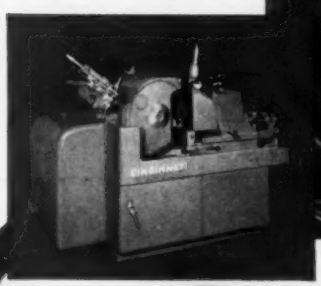
Finished to size at negligible cost on CINCINNATI FILMATIC CENTERLESS GRINDERS

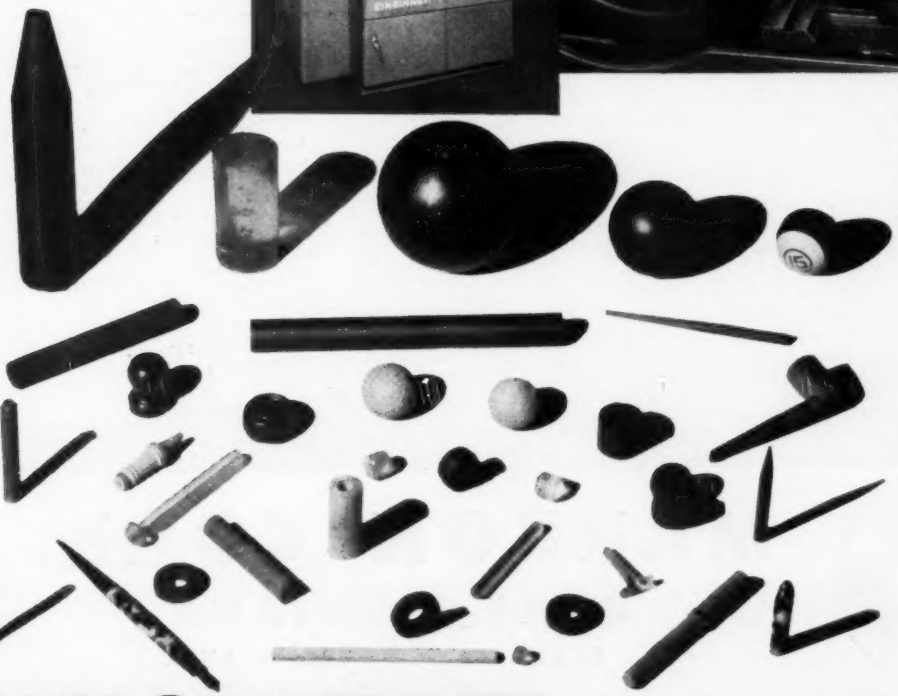
Adding a grinding operation to your cylindrical and spherical plastic products need not price them out of the market. CINCINNATI FILMATIC Centerless Grinders have the potential to grind parts of this type at an extremely high rate of production and at negligible cost. Fountain pen parts, for example, are centerless ground on a CINCINNATI at a production rate of 1200 per hour. ¶ Investigate the CINCINNATI centerless method of improving accuracy and quality of finish on plastic parts. Brief description of the CINCINNATI FILMATIC line of Centerless Grinders will be found in Sweet's Machine Tool Catalog; complete data may be obtained by writing for literature. For the No. 2 size machine, ask for catalog No. G-611-1.

CINCINNATI GRINDERS INCORPORATED
Subsidiary of The Cincinnati Milling Machine Co.
CINCINNATI 9, OHIO



CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Catalog No. G-611-1.





Pool and billiard balls of several sizes from 1¼" to 2" diameter are accurately ground to a high-quality finish on this CINCINNATI FILMATIC No. 2 Centerless Grinder.

Variety of plastic and other non-metallic parts ground at low cost on CINCINNATI FILMATIC Centerless Grinders.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Introducing-

A NEW PRODUCTION CHAMP

CYCOLAC

A *New* HIGH-IMPACT THERMOPLASTIC RESIN

CYCOLAC is a single uniform resin which is permanently thermoplastic, permitting fast molding, calendering and extruding, and re-use of trim and cutting scrap. Also economical to form from press-polished sheets by vacuum, air-pressure, or mechanical methods over inexpensive molds of wood, plaster, aluminum, etc.

CYCOLAC is free from nerve or shrinkage; with a high in impact-resistance and heat-distortion temperature, plus a low brittle point. Resistant to many oils, solvents and corrosive chemicals.

Very light — Sp. Gr. 1.01 . . . dimensionally stable . . . soluble in selected solvents, for potential coatings applications. Readily injection-molded, extruded and calendered.

GET THE FACTS — Write TODAY for TECHNICAL LITERATURE

Some of the 1,001 End Products Made with CYCOLAC

- Chemical & Industrial Piping
- Molded Pipe & Industrial Fittings
- Corrosion-proof Valve Bodies
- Signs — Display Racks
- Desk Tops
- Profile Extrusions
- Beverage Dispensers
- Tote Boxes
- Carpet-Sweeper Housing & Wheels
- Kitchen Accessories
- Post-Formed-Sheet Furniture
- Rain Gutters
- Appliance & Tool Handles
- Bottle Closures

Marbon

MARBON CORP.

GARY, INDIANA

SUBSIDIARY OF BORG-WARNER

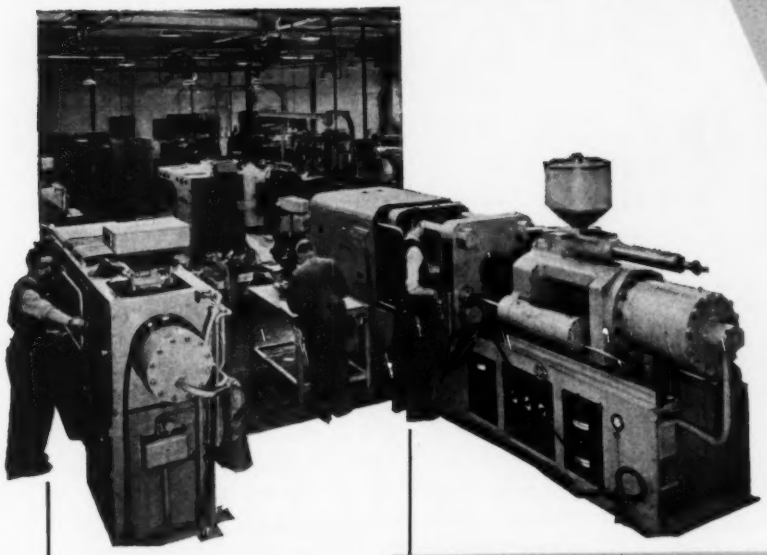
MARBON . . . *Precision Resins for Precision-Made Products*

What do you need most from your machines--

HIGH PRODUCTIVITY
HIGH QUALITY MOULDINGS
LARGE PLASTICISING CAPACITY
ACCURATE TEMPERATURE and PRESSURE CONTROL
EASE OF MAINTENANCE

PECO PRODUCTS

Give you all of these-and MORE



The above illustration shows a massive battery of PECO 8-oz. and 16-oz. Injection Moulding Machines at the works of E. K. Cole (Ekco Plastics).

Indeed PECO Injection Moulding Machines are the finest of their type in the world, designed and manufactured by experts to serve in the most efficient manner the constantly developing Plastics Industry. The Machines are built in a range from 2 to 32 ounce capacities, embodying many new and valuable features. Illustrated literature on all machines will be sent on request.

THE
PROJECTILE & ENGINEERING
COMPANY LIMITED

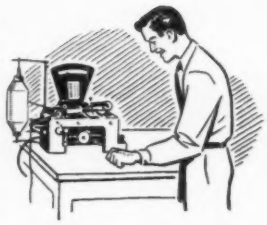
ACRE STREET, BATTERSEA, LONDON, S.W.1, ENGLAND

Telephone: Macaulay 1212 Telegrams: Profectus Claproad London Cables: Profectus London

UNIFORMITY Makes The Big Difference In LAMINATION FABRICS

MT. VERNON EXTRA

Gives You Greater Fabric Uniformity



Checking evenness of roving with Belger Tester. One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

FABRICS ENGINEERED TO FIT YOUR NEEDS

Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric – cotton, synthetic or blend – to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

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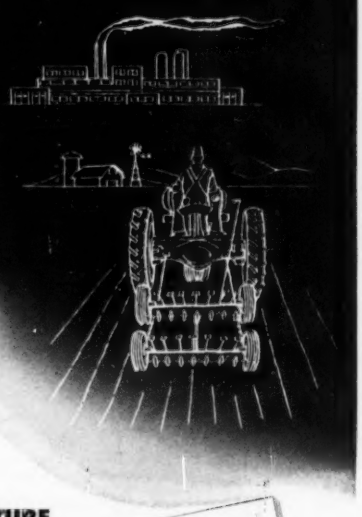
Main Office: 40 Worth St., New York
Branch Offices: Chicago • Atlanta
Baltimore • Boston • Los Angeles

TURNER HALSEY COMPANY
Selling Agents

A WORLD OF EXPERIENCE

coming into view . . .

GRACE CHEMICAL COMPANY



A new $20,000,000 urea and anhydrous ammonia plant near Memphis, Tenn., is progressing rapidly toward completion. Indications are that production will be available to the industrial and agricultural communities by the second half of 1954. This means that *NOW* is not too early for users of urea and ammonia to explore this new source of supply.

UREA AND ANHYDROUS AMMONIA FOR INDUSTRY AND AGRICULTURE

At the moment, Grace Chemical Company is acquainting these markets with its strong team of executive, technical, and production personnel. Also with the modern processing techniques of the new plant. Personnel and plant will be combined into a smooth-functioning, efficient organization—backed by a world of experience. If you have not seen the new illustrated brochure, "Introducing Grace Chemical Company," send the coupon with your business letterhead for your copy today.

GRACE CHEMICAL COMPANY
Hanover Square, New York 5, N. Y.

Please send me the illustrated brochure "Introducing Grace Chemical Company."

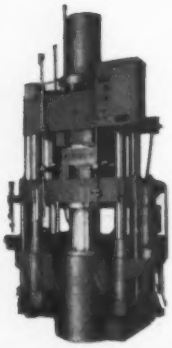
Name _____
Title _____
Company _____
Address _____
City _____ *Zone* _____ *State* _____

GRACE · CHEMICAL COMPANY
Hanover Square, New York 5, N. Y. • Memphis, Tenn.

The Logan

ATTENTION PLASTIC MOLDERS

Hydraulic Preformer gives you operational advantages



LOGAN HYDRAULIC PRESSES ARE THE NEW PACESETTERS FOR INDUSTRY. Logan makes a complete line of hydraulic presses for plastic or rubber molding, laminating, pressing, forming, staking and broaching. Capacity range 20 to 200 tons.

1. Preformer is hydraulically operated and is governed by push-button electronic controls. Plug-in relays, long-life cold cathode tubes together with control panel are fully enclosed in a dust proof case. Preformer operates on full automatic cycle with semi-automatic operation available for set-up.

2. Preformer has capacity of 25 square inches of sound preforms per cycle. Dies may have single or multiple cavities.

3. The Logan Hydraulic Preformer has a selective pressure range of 0 to 125 tons on the die. So accurate is the unit that weight of pills or preforms can be controlled with a variance of not more than ½ of 1%. This results in uniformity in preheating and more efficient molding.

4. The unit cannot be damaged by double stroke of preforms—Automatic Motor Stop if preform does not discharge due to lack of material or over-filled tote box.

5. No limit switches to adjust. Record of dial settings on shop card permits accurate, fast set-ups for re-runs.

6. Horizontal design permits gravity discharge, minimizing breakage and damage to preforms.

7. Horizontal design makes possible automatic preforming of impact type materials rapidly and accurately.

8. Operation is practically dust free. Rods and Guides are fully enclosed.

9. Made by a manufacturer of precision equipment in machine tools and hydraulic presses.

Write **for complete data on Logan Hydraulic Preformers and Presses.**

HYDRAULIC DIVISION

LOGAN ENGINEERING CO.

Chicago 47, Illinois

HIGH QUALITY at LOW COST

for reinforced polyesters

If you're seeking ways to get better polyesters at low cost, let us recommend the right DIAMOND Precipitated Calcium Carbonate for your product.

You'll get smoother surfaces, no cracks, no evidence of glass fibers when DIAMOND Carbonates are mixed with catalyzed, glass-reinforced polyesters. And your product gets improved wet strength and reduced shrinkage.

All these at lower volume cost.

DIAMOND offers these precipitated calcium carbonates for reinforced polyesters:

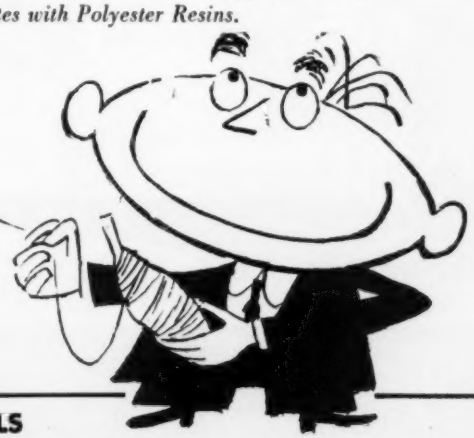
Surfex® MM—coated with 1% resin; particle size about 5 microns.

Kalite®—coated with 1% stearic acid; size about one micron.

Suspenso®—same as Surfex MM, but uncoated.

Multifex® MM—uncoated; particle size about .06 micron.

Write for DIAMOND technical bulletin: *No. 8 the Application, of Precipitated Calcium Carbonates with Polyester Resins.*



DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

DISTRIBUTORS OF THESE PRODUCTS: C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U. S. A.; Harrisons & Crosfield (Canada) Ltd.

DIAMOND ALKALI CHEMICALS®

DIAMOND CHEMICALS

FOR THE RUBBER AND PLASTICS INDUSTRIES

DIAMOND ALKALI COMPANY... CLEVELAND 14, OHIO

Welding Engineers Inc.
Continuous Processing Equipment

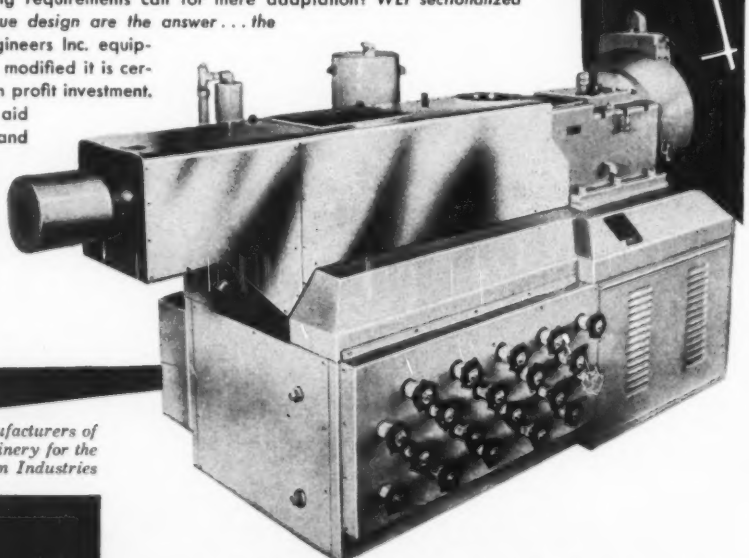
IS YOUR BEST LONG TERM PROFIT INVESTMENT

✓ THE UNIQUE DUAL WORM DESIGN

MAKES THE DIFFERENCE

The pattern of WEI customers repeats itself, over and over again. Wherever WEI Compounders-Extractors-Extruders are at work today, their superior capabilities . . . consistent higher quality and output . . . continue to paint an impressive production and profit picture. WEI customers know by experience that the wisest investment in processing equipment calls for a look at today's processing problems AND a careful perspective of tomorrow's potential processing requirements.

That's why the WEI Dual Worm Design is so important to you. Today's continuous processing requirements in your plant are met, and surpassed, because each machine is custom-fitted for you . . . and tomorrow's processing requirements call for mere adaptation! *WEI sectionalized dual worm combinations of unique design are the answer . . . the economical answer.* Welding Engineers Inc. equipment is so flexible and so easily modified it is certain to prove your best long term profit investment. Get the facts today . . . enlist the aid of our engineering department and our experimental laboratories in support of your own long term profits as a processor of plastics.



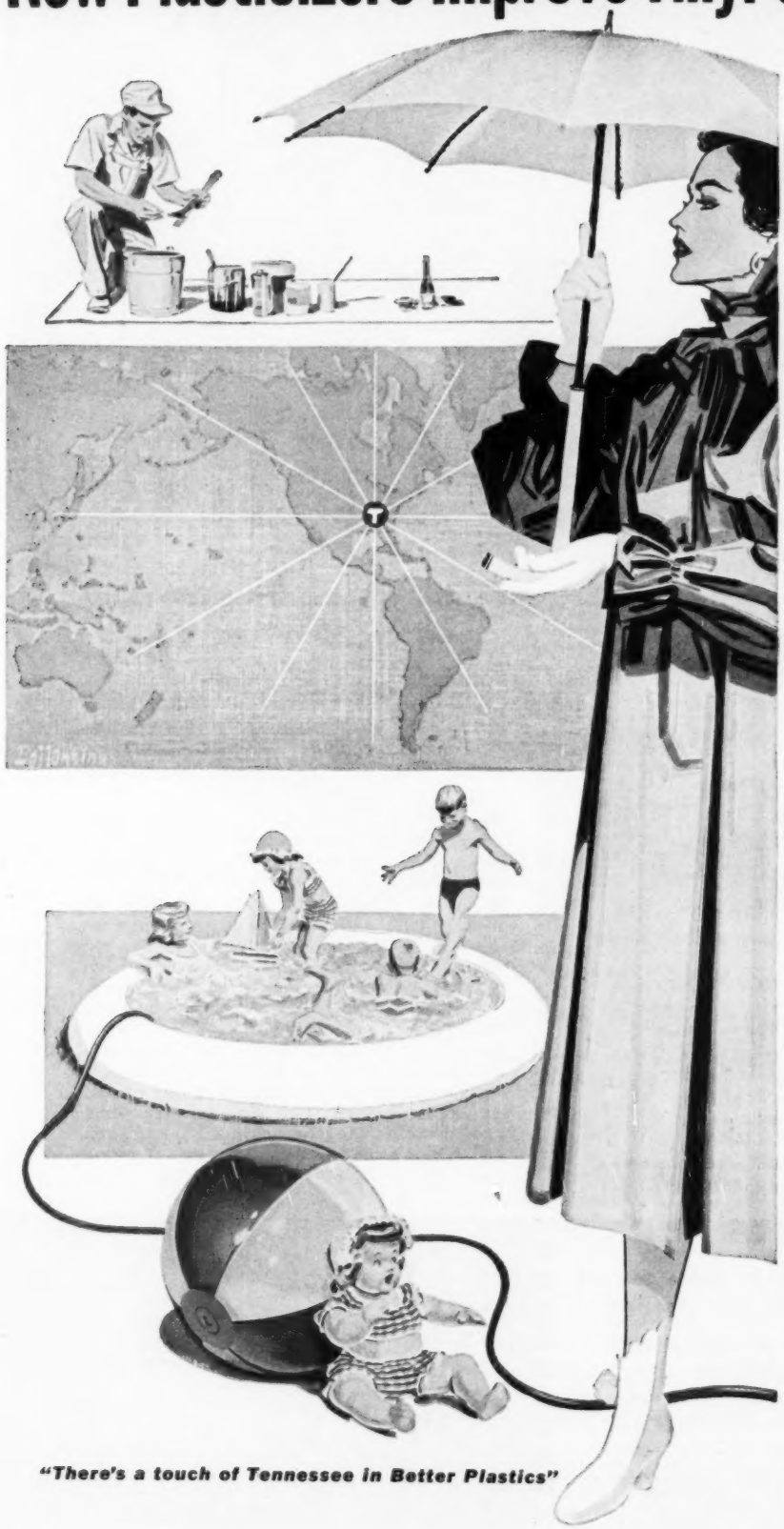
Manufacturers of Improved Machinery for the Plastic, Chemical and Petroleum Industries

WELDING ENGINEERS, INC

NORRISTOWN, PENNSYLVANIA

We welcome the opportunity to work with you in solving your compounding and extruding problems

New Plasticizers Improve Vinyl Compounding



"There's a touch of Tennessee in Better Plastics"

TENNESSEE announces Benzoflex 9-88 and Benzoflex 2-45 for PVC resins and other film formers.

These new primary plasticizers from TENNESSEE research bring these important advantages to manufacturers of film, plastisols, organosols, extrusions and emulsions:

Impart good tensile strength, elongation, elasticity and shore hardness to vinyl films.

Produce plastisols and organosols of low, permanent viscosity.

Volatility from films is very low. Does not crystallize at low temperatures.

Have strong solvent action on vinyl chloride resins.

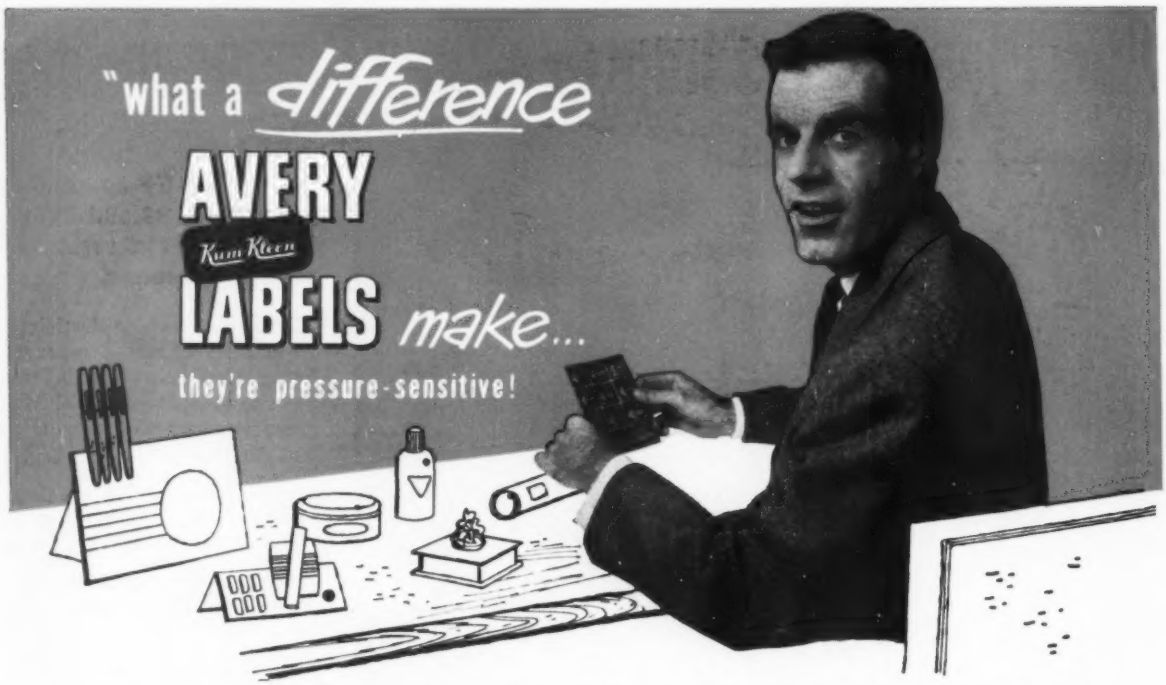
Their cost is low.

Benzoflex 9-88 and 2-45 are also compatible with cellulose acetate and nitrocellulose type resins.

Write today for complete information and samples of Benzoflex plasticizers.

TENNESSEE
PRODUCTS & CHEMICAL
Corporation
NASHVILLE, TENNESSEE

Producers of: **FUELS • METALLURGICAL PRODUCTS • TENSULATE BUILDING PRODUCTS • AROMATIC CHEMICALS WOOD CHEMICALS • AGRICULTURAL CHEMICALS**



. . . can't beat 'em for advertising and informative labeling —on the PRODUCT, PACKAGE or POINT OF SALE!"

Make your products *talk!* Even when there's no salesman around, Avery Kum-Kleen Labels work for you—*at the point of sale!* With fingertip ease they're laid on the product or package to point out sales features and advantages—information and instructions. They tell your customer what he's buying...why he should buy...and how to use it!

■ For advertising and merchandising work, Avery Pressure-Sensitive Labels put your message right where you want it—on the package, product or on any clean, smooth display surface.

■ Avery Kum-Kleen Labels are on in an instant—with *no moistening* or waste motion. They stick tight and won't dry out, curl or pop off...they stay neat and attractive through rough handling—yet they're easily removed, when necessary, without soaking or scraping!

■ Available in any size, shape or color... they're individually die cut on sheets or in rolls for automatic labeling at production-line speeds. Patented Avery Dispensers, in either manual or electric models, can save you real time and money—write now for more information and free samples of Avery Pressure-Sensitive Labeling—*do it today!*

SPECIFICALLY SPEAKING...

Here are a few practical uses of Avery Kum-Kleen Labels. Where can *your* business use these labels in sales promotional work?

- *trade marks*
- *anniversary promotions*
- *product identification*
- *guarantees*
- *price labels*
- *diagrams*
- *servicing instructions*
- *sales stickers*
- *special feature labels*
- *special promotion stickers*
- *point of sale stickers*
- *product information*
- *special instructions*
- *warning labels*
- *address changes*
- *package labels*
- *contents labels*
- *color coding*
- *maintenance instructions*
- *advertising tie-in labels*

AVERY ADHESIVE LABEL CORP., Custom Div. 128

117 Liberty Street, New York 6 • 608 S. Dearborn Street, Chicago 5
1616 S. California Ave., Monrovia, Calif. • Offices in other principal cities

☐ Please send case histories and free samples ☐ Have the Avery Label man call

*Name*_____

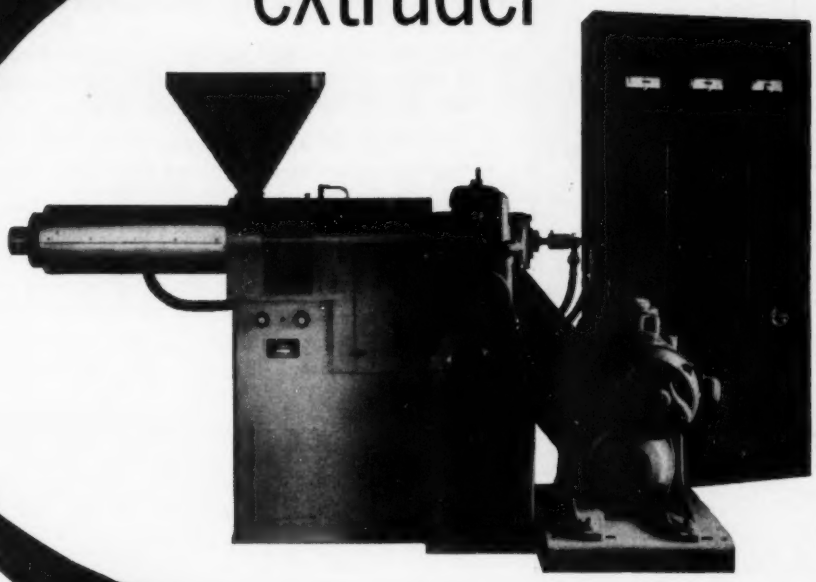
*Company*_____

*Address*_____

*Our Business Is*_____

Egan

extruder



Remote Control Panel

Internal wiring for extruder and control panel complete to coded terminals for quick installation at any location.

FOUR SEPARATE MAIN COMPONENTS

● "Tailored" Screw ● Independent Thrust Bearing Housing

● Individual Feed Section ● Heavy Wall Cylinder

ALL WITH IMPROVED FEATURES

for increased production, reduced maintenance and complete flexibility. Designed to meet *ANY* requirements. Can be supplied complete with dies and take-off equipment.

Write for details or invite our representative to call

FRANK W. EGAN & COMPANY

Designers and Builders of Machinery
for the Paper Converting and Plastics Industries

Bound Brook, New Jersey

Cable Address "EGANCO"—BOUNDBROOK, N.J.

Call on A D P...

for the highest quality dispersions

In polyethylene, thoroughly dispersed carbon black is the most effective way of screening pipe and cable sheathing from the effects of sunlight.

This is just one of the many important jobs color dispersions are accomplishing in plastics today.

A D P concentrated dispersions of carbon blacks and other pigments are the finest you can obtain, reflecting 48 years of dispersing experience. The exact color you want, completely dispersed in any of a variety of plastic resins and other vehicles, is available from A D P.

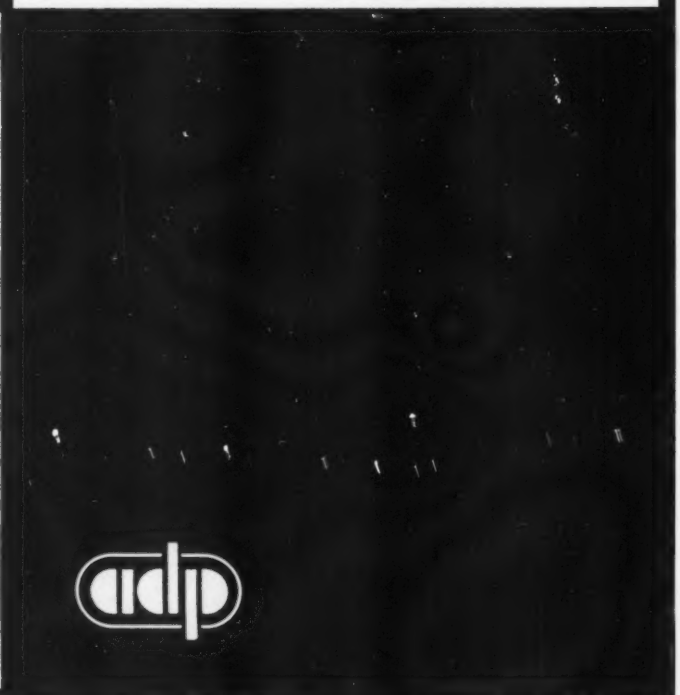
If it's not a stock dispersion, we'll be glad to prepare one to meet your special requirements.

Why not let us send you samples to test in your own laboratory? Just write or call:

Acheson Dispersed Pigments Co.

2252 E. Ontario St., Philadelphia 34, Pa.

. . . also Acheson Colloids Ltd., Slough, England



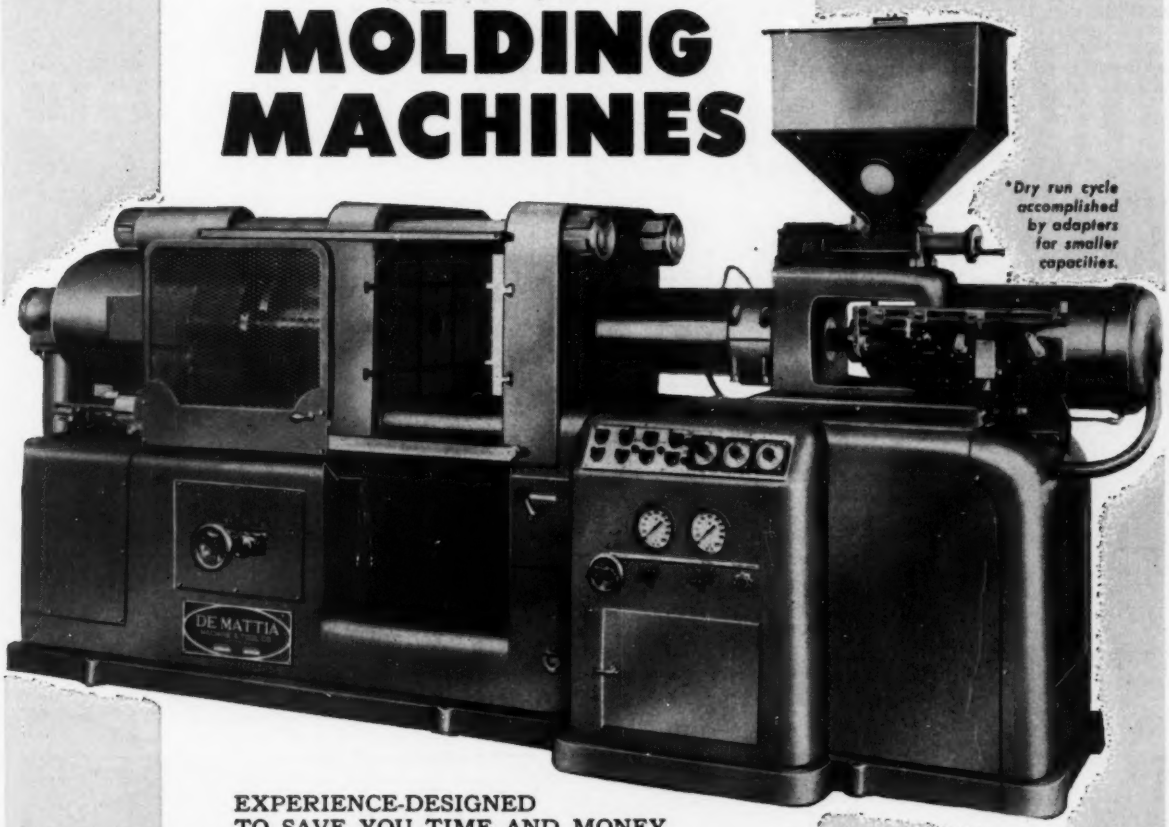
NOW- 27% more molding production!

—WITH THE SENSATIONAL NEW

DE MATTIA
SERIES M
MOLDING MACHINES

- IMPROVED DESIGN
- FULLY HYDRAULIC OPERATION
- UP TO 6 CYCLES PER MINUTE*
- 16 OUNCES BY AUTOMATIC PRE-PACKING

*Dry run cycle accomplished by adapters for smaller capacities.



EXPERIENCE-DESIGNED TO SAVE YOU TIME AND MONEY

the new Model M Molding Machines are another step forward in molding production. These high efficiency injection machines help you meet competition... are expressly designed to increase your molding production and cut your molding costs. Series M machines offer fully hydraulic operation, up to 6 cycles per minute on smaller shots and shots up to 16 ounces by means of automatic pre-packing!

Available in 8 and 12 oz. Models. The De Mattia Line also includes 4 oz. Verticals, 3 oz. Horizontals and Various Models of Scrap Grinders. Write for Illustrated Bulletins.

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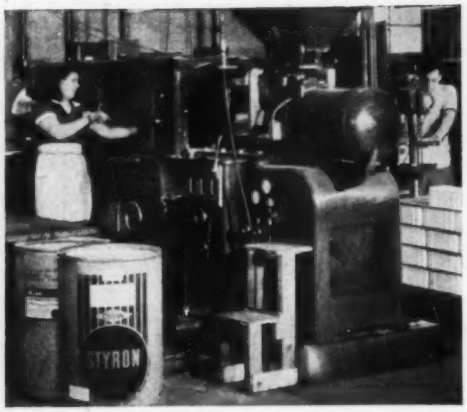
Mold Making Here is a section of our tool room where skilled tool makers, working closely with our designers and engineers, turn out intricate molds designed and built for long, trouble-free production runs. Experienced engineers and designers are at your service to work with your engineering staff or to handle the entire job for you.



Injection Molding Injection equipment permits an unlimited choice of both color and material. Our presses, equipped with the most modern control devices, mold polystyrene, acetate, butyrate, polyethylene and nylon in a wide range of sizes.

A *Complete* Source for Quality Plastic Moldings

FROM start to finish, Mallory Plastics' facilities and services are complete, designed to handle your job economically and to your most exacting requirements. Designing, material selection, tooling and production are integrated as a complete service. Modern equipment includes facilities for compression molding, transfer molding, injection molding, hot stamping, glass-reinforced plastic molding, spray decoration and assembly.

If your product, or any of its components, can be produced in plastics, write or call us for complete details. Regardless of design requirements, we can do the job to your specifications . . . with delivery to meet your schedules.

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Compression and Transfer Molding The most complicated plastic parts, requiring exacting tolerances, can be molded by our modern equipment. Presses ranging from 75 tons to 750 tons capacity, provide facilities for producing parts of all sizes. Proper material storage and conditioning, electronic pre-heating and special control devices insure high production and prompt delivery.

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It's *BETTER*

OHIO-APEX OHOPEX Q-10
PLASTICIZER

LOWER COST

LESS MIGRATION

BETTER U. V. LIGHT STABILITY

BETTER LOW TEMPERATURE FLEX

For complete technical information concerning OHOPEX Q-10 write for our catalog.

OHIO-APEX DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
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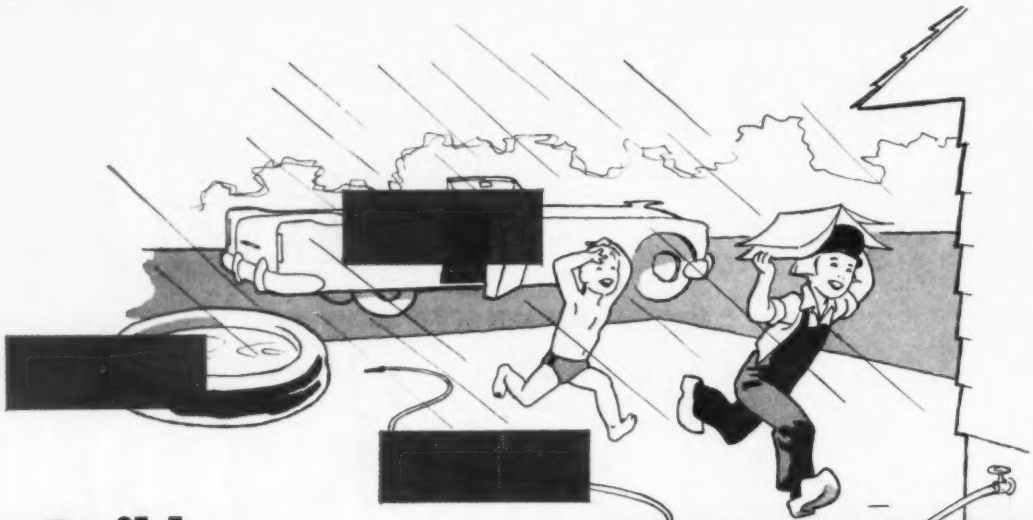

Build up the weather resistance of your vinyl products

...stabilize with "Dutch Boy" Dyphos

The sun and the rain can be an awful pain to makers of opaque vinyl products.

But not if they are stabilized with "Dutch Boy" Dyphos!

That's because Dyphos gives unequaled light stability. This builds up the weather resistance of your opaque vinyls, gives them excellent color retention, long-lasting flexibility.

Dyphos also imparts excellent heat stability. And this pays off, as you know, in processing.

So, whether you work with plastisols or organosols ... whether your method is slush or conventional molding, extruding, calendering, or coating ... use "Dutch Boy" Dyphos.

For more information on Dyphos (or any of the other "Dutch Boy" stabilizers) just write. We will be glad to supply factual data and technical assistance.

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
[redacted]	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears
CALSTAR (Calcium Stearate)	Where non-toxicity and lubricity are required
LEADSTAR (Lead Stearate)	As lubricant and co-stabilizer

Dutch Boy

*Reg. U.S. Pat. Off. **CHEMICALS** *

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Every Day More Plastics Manufacturers *Standardize on*

NRM Extruders

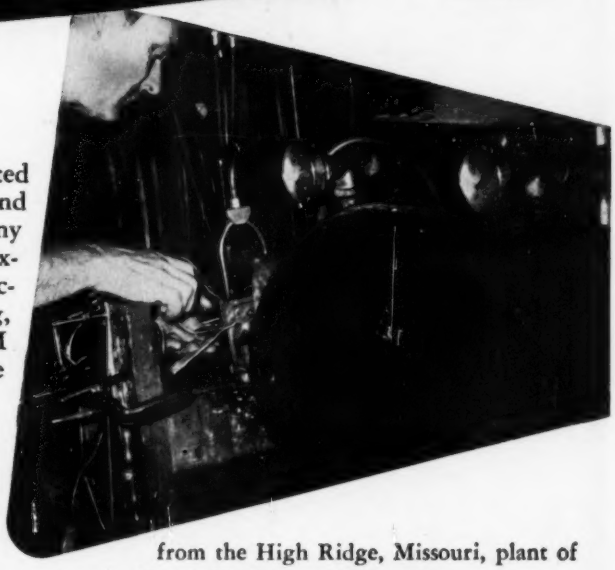
NRM
MODEL 50
2½"
ELECTRICALLY HEATED
THERMOPLASTICS
EXTRUDER

HERE'S WHY...

If you are *not* an NRM owner, you'll be interested in the *reasons* behind the higher performance and lower maintenance costs which cause so many plastic processors to standardize on NRM Extruders. Finest materials and precision construction are *basic,* of course, and assure the long, trouble-free operating life which has made NRM extruders famous in large and small plants the world over.

Then there's design. Balanced heat control, the quick-opening die gate and corrosion-resistant "cyliner" construction — all NRM "firsts" — work together to obtain the higher output of top quality extrusions which makes NRM Extruders the most *profitable* machines to operate.

At no obligation we'll send you *full* details on the NRM line . . . the only *complete* line of thermoplastic extruders and equipment. Write us *today.* Compare the advantages of NRM Extruders with any other make, and you, too, will standardize on NRM Extruders.



from the High Ridge, Missouri, plant of

K-S-H Plastics, Inc.

Mr. R. S. Hawes, III, writes:

"OUR NRM EXTRUDERS HAVE ALWAYS GIVEN HIGH PERFORMANCE IN BOTH PRODUCTION AND QUALITY. ALSO, OUR RECORDS SHOW THEIR MAINTENANCE COSTS ARE LOW. WE'VE PURCHASED ONLY NRM EXTRUDERS SINCE THE FIRST ONE WE INSTALLED, AND INTEND TO STANDARDIZE ON THIS EQUIPMENT."

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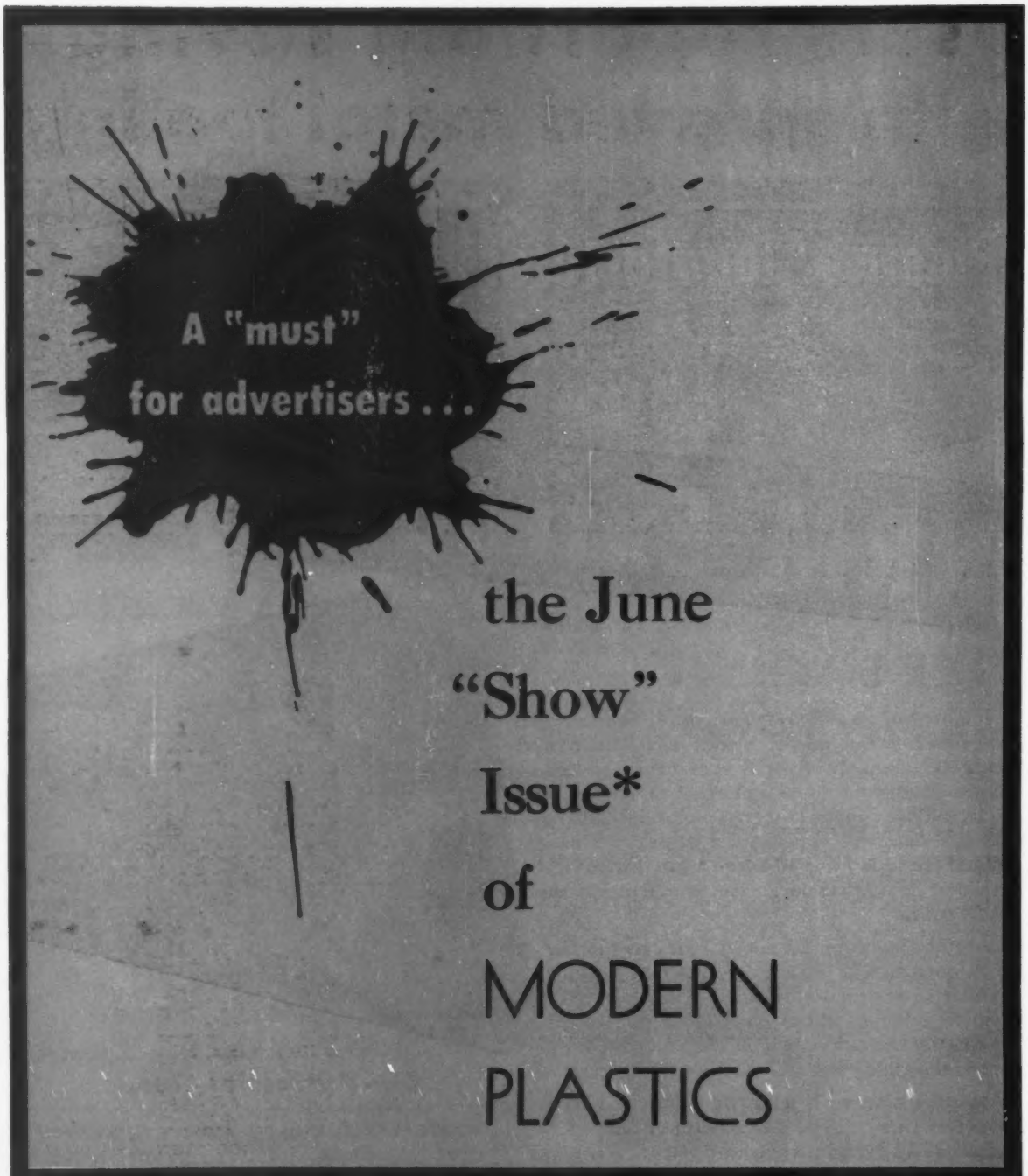
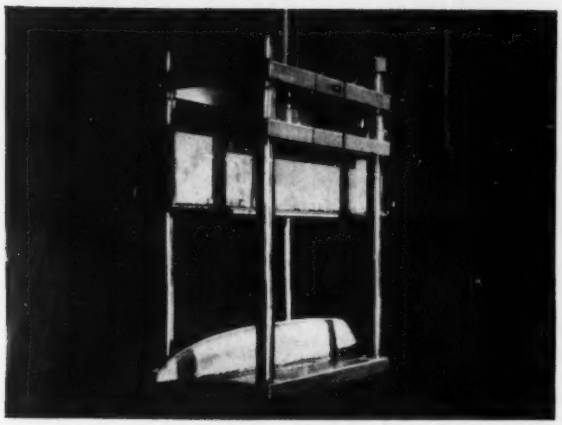


* coinciding with the Sixth National Plastics Exposition to be held in Cleveland, Ohio, June 7-10.

users report big savings with sprayed metal tooling



Photos courtesy Narmco Mfg. Co., San Diego, Cal.

Typical glass laminated part produced from sprayed metal tooling in press shown. Match molds for this jet aircraft wing tip were built up with alternating layers of sprayed aluminum and bronze over sprayed zinc base and backed with copper tubing, reinforced and insulated with laminated glass cloth. Tubing carries steam for cure, after which cold water is used to chill male for next layup.

new bulletin provides data round-up on current successful applications

Reports from users of sprayed metal tooling on recent successful applications form the basis for a new data bulletin, now available without charge. These case histories demonstrate the substantial savings in time and money over other tooling methods, point up possible pitfalls that can be avoided in tool design and fabrication.

Data covers general procedures, describes and illustrates tooling now in use and plastic production parts. Write for a copy of this new data bulletin, or use the handy coupon below.

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38-14 30th Street LONG ISLAND CITY 1, N. Y.
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Please send me free copy of Bulletin 111 — Sprayed Metal Tooling. No obligation, of course.

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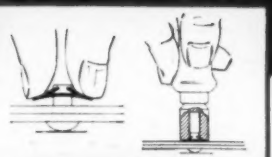
NEW Tinnerman Push-On SPEED NUTS®

...for wide range of applications

– PRICE SAVINGS AVERAGE 25%!

● Tinnerman, originators of Push-On type SPEED NUTS, offers this new C12000 Series at substantial savings! Large volume, high speed production, plus years of engineering and manufacturing experience make this economy possible! These new lightning-fast Push-Ons are available in a complete range of popular sizes, with rust-resistant finish, for round, D-shaped or rectangular studs. A unique feature, exclusive with Tinnerman Push-Ons, is their use over D-shaped studs where removability is desired.

Call or see your Tinnerman representative for full, cost-saving information about these new, low-priced Push-On type SPEED NUT brand fasteners.



NEW C12000 Push-On SPEED NUTS

...are one-piece, self-locking, spring steel fasteners. Start by hand...zip down over integral studs, rivets, tubing, nails, any unthreaded parts; bite lock on smoothest, hardest surface!

Send today for copy of "Greater Savings Than Ever with C12000's"; also FREE Production Samples! Write: TINNERMAN PRODUCTS, INC., Dept. 12, Box 6688, Cleveland 1, Ohio. *In Canada:* Dominion Fasteners Ltd., Hamilton, Ontario. *In Great Britain:* Simmonds Aerocessories, Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S. A. – 7 rue Henri Barbusse, Levallois (Seine).

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Our facilities for warehousing enable us to supply you with plastics for all your needs . . . quickly, economically. Catalog and prices on request.

Write for 3 Free Booklets

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WRITE FOR FULL INFORMATION ON SIZES AND AVAILABLE TYPES.

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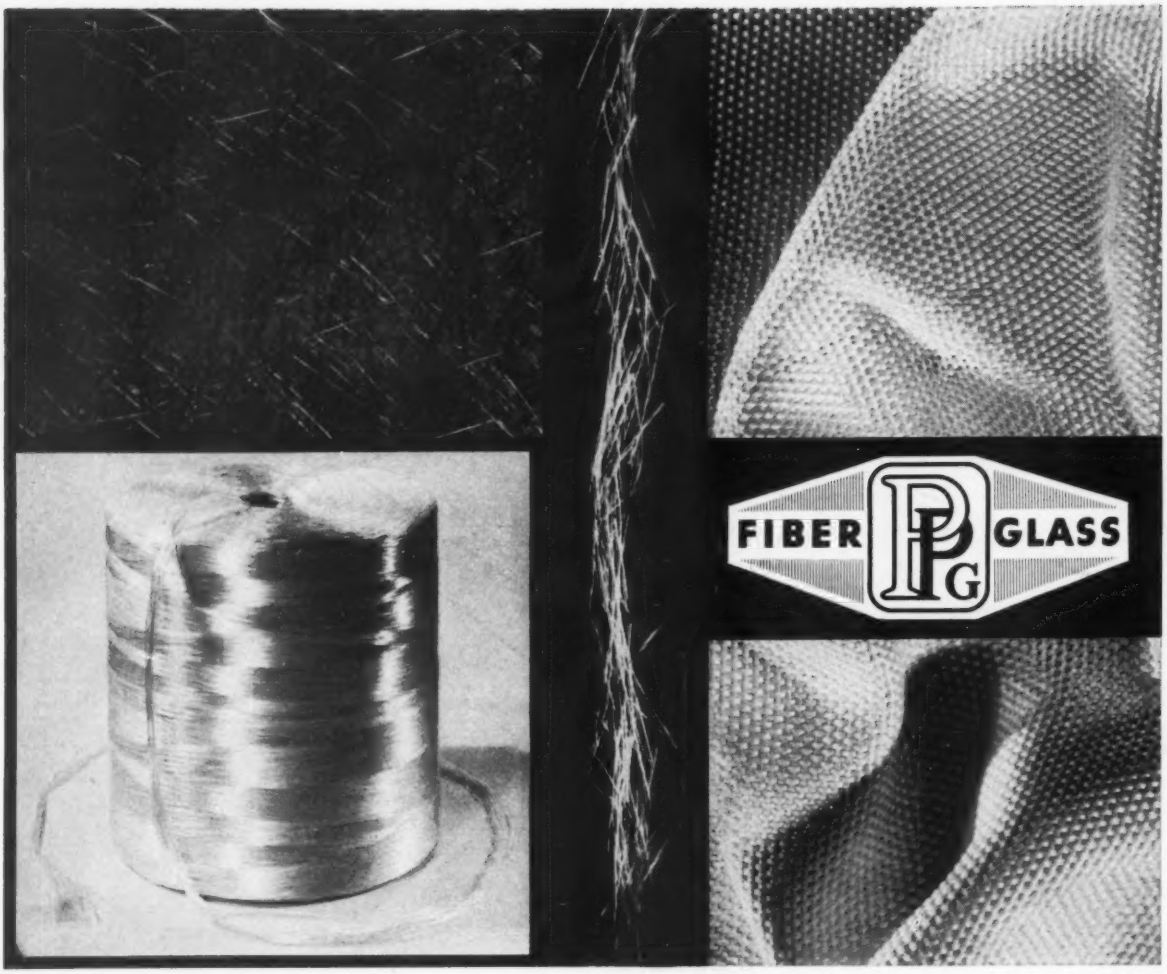


Uniformly high quality in plastics reinforcements

Today's rapidly growing applications of reinforced plastics call for reinforcements of exceptional uniformity in the molding process. Now, at the nation's newest glass fiber plant, such uniformity of glass fiber filaments is a reality—the result of extremely accurate manufacturing controls created from the 70 years' experience in glass making of Pittsburgh Plate Glass Company.

To you, as a molder, this uniformity means better laminating results and, most important, better product quality in all of your reinforced plastics molding.

Pittsburgh Fiber Glass reinforcements are readily available as roving (made from 140's yarn size), or as chopped strands (also 140's yarn size) cut to standard lengths from ¼" to 5". You can also obtain Pittsburgh Fiber Glass in the form of reinforcing cloth or mats from reputable weavers or manufacturers whose names we will supply upon request.

Prove Pittsburgh's high quality to yourself by arranging for tests today through our executive offices or district sales offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

Write today for your copy of a new folder describing Pittsburgh Fiber Glass plastics reinforcements. Address your request to our executive offices at Pittsburgh.

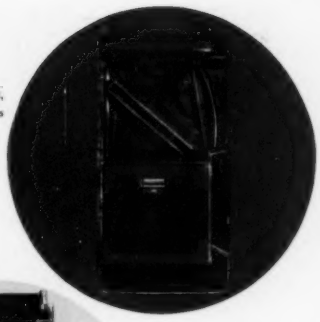
FIBER PG GLASS **PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS**

PITTSBURGH PLATE GLASS COMPANY

MICO-VUÉ, molded and assembled for Mico Photo Products, Chicago

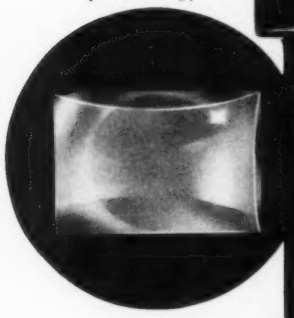
Baby picture, Santa Fe Photo

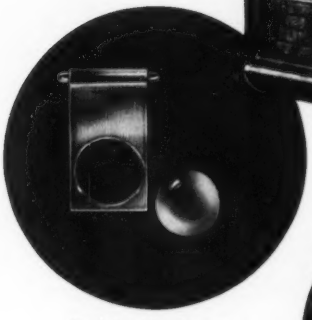
Inside side-section view, note insets



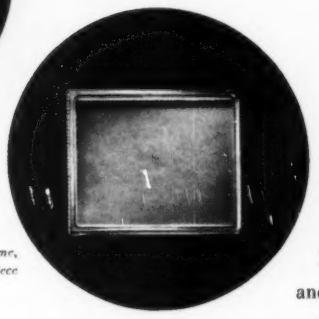
Outside side-sectional view, note design detailing

Fine optical glass lens, which, together with reflecting mirror, was included in our assembling job





Plastic lens hinged mount for magnifying glass



Plastic diffuser and frame, molded in one piece

NEW VIEWER

New View on what Plastics Can Do

You can draw some profitable conclusions for your own plastic products from these views of Mr. "Mike" Wolk, president of Mico Photo Products. Mr. Wolk said he wanted his viewer to be plastic not only because of the lower production cost, but for the greater attractiveness and color variety which he felt plastics afforded over other materials. This, then, was a complete start-to-finish molding and assembling job for us. Everything that went into this new viewer except its fine precision optical lenses and metal slides was made of plastic. Economy and strength were the factors in molding the Mico-Vué with a minimum number of castings. The light diffuser and frame were molded in one piece for greater economy and more attractive appearance. Even the lens hinge mounts were molded. Although this viewer is new, the idea of doing a thorough engineering and molding job economically and beautifully is an old story with us. We'd like to tell you that story and show you how we can serve you. Just let us know when we may. We'll do the rest.

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about ~~CROWN PLASTICS~~ piping, tubing and fittings, write for circulars containing data and illustrations.*

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MILLS PLASTIC DIVISION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Fibestos, Lucite, Nylon, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Corex, Forticel, ~~CROWN PLASTICS~~, Saran, and other Thermoplastic Materials.

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offers unexcelled facilities for building your molds

COMPLEX DESIGN

One of the industry's best-equipped and most ably staffed toolrooms is yours to use, here at **MPc.** Here you will find advanced types of equipment operated by highly skilled, experienced craftsmen.

MPc will make all your molds, operating like your own mold-making department. Or you may wish to call on **MPc** for a single job that won't fit into your production schedule...or a mold that's too large for you to handle...or one that poses difficult engineering problems. **MPc** *samples all molds, regardless of size, and submits piece parts for dimensional check before releasing molds.*

CLOSE TOLERANCE

In pacing the advance to ever-larger plastic castings, **MPc** has acquired an unparalleled fund of experience in mold design, engineering and fabricating. Submit your mold-making problems to MOLDED PRODUCTS, 4535 W. Harrison St., Chicago 24, Illinois.

EXCEPTIONAL SIZE

MOLDS FOR

- Compression molding
- Injection molding
- Plunger transfer molding
- Pot transfer molding
- Extrusion molding
- Rubber molding
- Die-casting
- Forging

Etc.

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DIVISION OF
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...Pace-Makers in Plastics Molding

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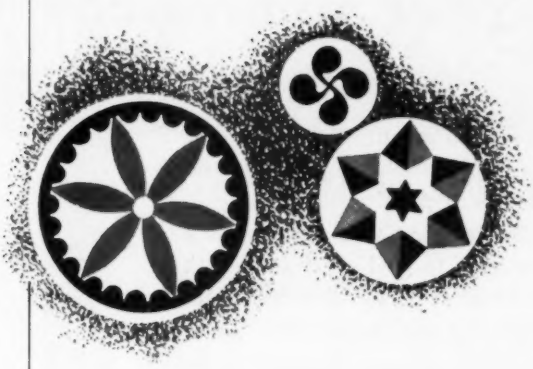
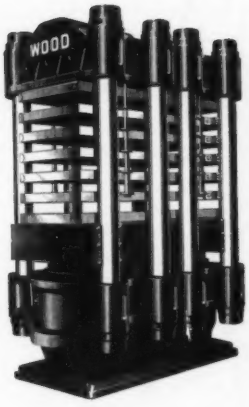
Do you believe in hex signs?



In Pennsylvania Dutch country, the hex sign on the barn is mighty important. The farmer has confidence in its power to protect against evil. In the business world, customers believe in, and rely on, the name of the manufacturer. For instance—to people in metalworking, woodworking, rubber and plastics, the R. D. Wood name is a sign of real value in hydraulic presses . . . good presses that turn a profit for them year after year. To you as a buying influence, the 150-year-old Wood name can mean a lot, too. Economy and efficiency in production, for one thing. If you like, we'll send you a descriptive catalog.



IN RUBBER AND PLASTICS, THE PAYOFF'S AT AN R. D. WOOD PRESS LIKE THIS ONE!

This 1,327-ton multiple-opening hydraulic press is used for the manufacture of molded brake lining and similar products. Can be furnished in various sizes and capacities to meet production needs. R. D. Wood presses are made for use in many industries. Ask for catalog, and for engineering aid—both yours without obligation.

R. D. WOOD COMPANY

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MAKERS OF HYDRAULIC PRESSES AND VALVES

FIRE HYDRANTS

CAST-IRON PIPE

GATE VALVES

GAS PRODUCERS

ACCUMULATORS

Are your tolerances too tight?

"If your tolerances are tight, your purse will get light" is a rule all plastics buyers come to know. Since every plastic item is subject to shrinkage after molding, your mold maker and your molder have to pool every iota of their know-how to adhere to split-thousandth specifications. And you are the one who pays.

Boonton can meet tight tolerance specifications with the best of them. But honestly, we hate to see you toss your money down the drain for precision tolerances in places where they are absolutely uncalled for.

Don't, for goodness sakes, specify "all pieces to measure ±.002" " when "all pieces to measure ±.005" " will work just as well. Remember, molders don't work for exercise, they work for that old green stuff, and the closer the tolerance, the bigger the bite.

If Boonton is your molder—and if we aren't, we hope someday to be—we'll never let you blind-alley yourself into tolerances that are tighter than need be.

To summarize Boonton's advice on close tolerances: specify 'em only when you need 'em.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

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More service from Monsanto...

INCREASE YOUR PROFITS
Upgrade Vinyls
with MONSANTO PLASTICIZERS!

Monsanto Standard Plasticizers

DOP (di-2-ethylhexyl phthalate) . . .
the most widely used plasticizer in the vinyl industry. A dependable standard for sheeting, free film, vinyl dispersions, and extrusion formulations.

DIOP (diisooctyl phthalate) . . .
Similar to DOP with superior plastisol dispersion characteristics. Excellent for film, sheeting, and vinyl dispersions.

DOA (di-2-ethylhexyl adipate) . . .
Possesses excellent low-temperature flexibility, below −65°C. Has low viscosity in plastisols. Widely used in garden hose, free film, sheeting, plastisols, organisols and extrusions.

TCP (tricresyl phosphate) . . .
Gives a rapid fusing action and has high resistance to staining, oils and greases. Possesses excellent flame-retarding properties. TCP is widely used in vinyl wire insulation, floor tile, and in free film and sheeting to provide flame retardency.

New Monsanto Plasticizers

DIDP (diisodecyl phthalate) . . .
Ideal wherever low volatility and efficiency are needed. Can be used in electrical insulation, film and sheeting, floor tile and other applications.

DNODP (di-n-octyl, n-decyl phthalate)
can upgrade vinyl by increasing their flexibility and lowering volatility. This plasticizer imparts good resistance to soapy and boiling water.

DIDA (diisodecyl adipate) . . .
less volatile plasticizer than DOA. Imparts excellent low-temperature flexibility and offers improved garden hose, upholstery stock, film and sheeting, coated fabrics, and vinyl dispersions.

Santicizer 140 (cresyl diphenyl phosphate) and Santicizer 141 (alkyl diaryl phosphate) . . .
both compounds impart flame retardency, good grease, oil and stain resistance. These plasticizers have good low-temperature flexibility and excellent light stability. Widely used in film and sheeting, and excellent for increasing fusion rate of vinyl dispersions and extrusions.

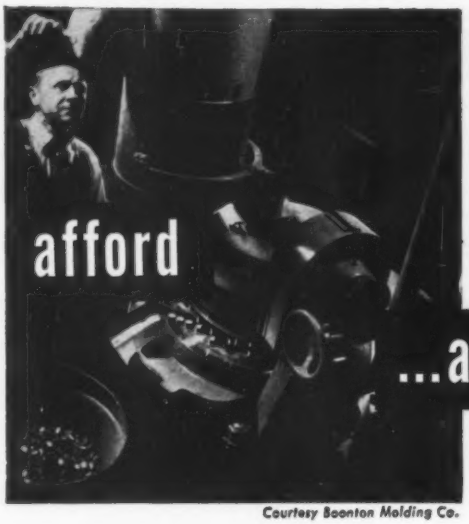
Santicizer Reg. U. S. Pat. Off.

For more information: write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478, St. Louis 1, Missouri.

MONSANTO
CHEMICALS—PLASTICS

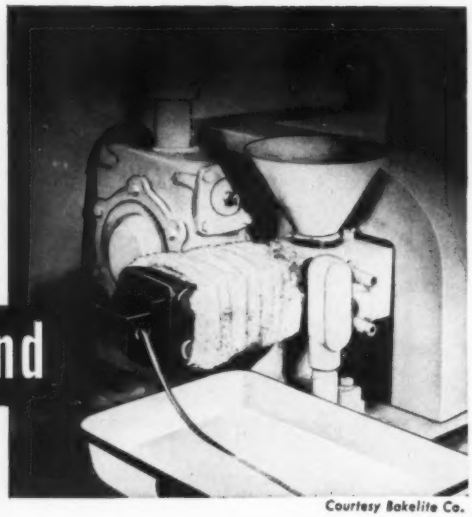
SERVING INDUSTRY...WHICH SERVES MANKIND

METASAP* STEARATES



Courtesy Boonton Molding Co.

...and



Courtesy Bakelite Co.

superior lubricants in molding compounds

outstanding thickeners for plastisols

Metasap Calcium and Zinc Stearates are unsurpassed as lubricants — in molding compounds, or when dusted onto surfaces of mold cavities. Molders using them eliminate preform delamination, and breakage of finished products, because all *ejection pressures are minimized.*

If the importance of economy cannot be overemphasized in your compression molding, you'll find *nothing more profitable* than Metasap stearate lubrication. Metasap Calcium and Zinc Stearates will assure improved preforms, improved finished products, and increased output *at less cost.*

If you manufacture plastigels, look to Metasap Stearates. Not only have these quality metallic soaps proved *successful gelling agents,* but their *ready availability* and *basic economy* offer advantages you cannot afford to overlook. We'll be pleased to provide samples of —

Metasap Magnesium Stearate
Metasap Barium Stearate
Metasap Calcium Stearate
Metasap Aluminum Stearate

at no cost and without obligation, to help you select just the thickener, or thickeners, you find best for the plastisols you are handling.

*Reg. U.S. Pat. Off.

METASAP CHEMICAL COMPANY REG. U.S. PAT. OFF.

For complete information, write

METASAP CHEMICAL COMPANY, HARRISON, N. J.

Chicago • Boston • Richmond, Calif. • Cedartown, Ga.

Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

Gage stays accurate roll after roll
with calender rolls on TIMKEN® bearings

TO *maintain* accurate gage of plastic film for the length of the roll, roll after roll, the Adamson United Company mounts the rolls of its 36″ x 92″ and 8″ x 16″ 4-roll calenders on Timken® tapered roller bearings. Rolls stay in accurate alignment longer than is possible with sleeve-type bearings.

By holding gage to minimum tolerances, Timken bearings increase yield—allow you to get more yards per pound of material. And because there is no friction between roll neck and bearings, roll neck wear is eliminated. Fewer overhauls are necessary. Downtime is reduced because roll necks don't have to be machined.

The true rolling motion and smooth surface finish of Timken bearings practically eliminates wear within the bearings. Precision is *maintained.*

The gear stand driving the larger calender is also equipped with Timken bearings—a total of 19.

Timken bearings are tapered in construction permitting them to take radial and thrust loads in any combination. And due to line contact between rollers and races, Timken bearings have load-carrying capacity to spare. Get the advantages of Timken bearings in your calenders, mills, refiners, and mixers. For full information, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

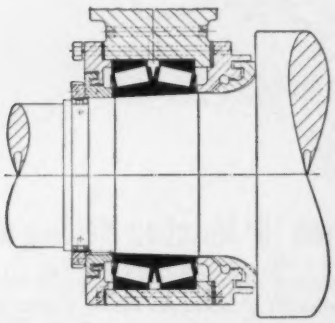
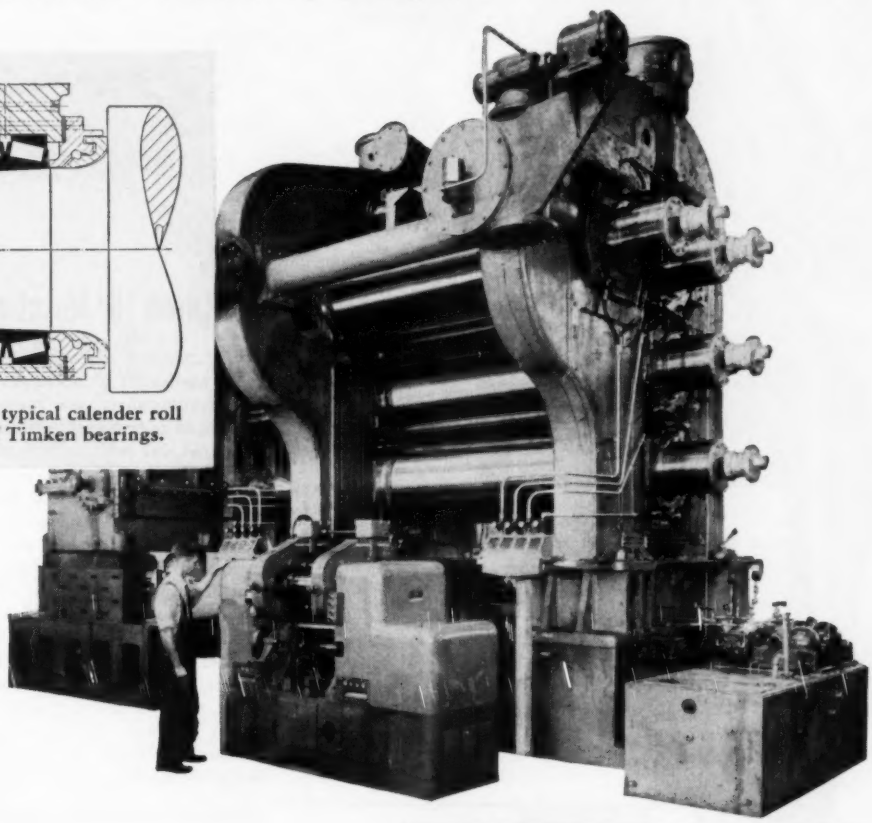
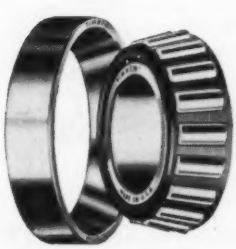


Diagram shows typical calender roll application of Timken bearings.





TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

WE MAKE OUR OWN STEEL

The special grade alloy steel which gives Timken bearings their strength and resistance to wear is made in our own steel mills.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ↓ AND THRUST → ← LOADS OR ANY COMBINATION

HOTTER'N A SHERIFF'S PISTOL!

The Lewis "6" Injection Molding Machine

. . . is changing all established concepts of economy, speed and safety of operation among plastics molders. This revolutionary new machine will plasticize 60 pounds of polystyrene per hour and can mold large projected area parts weighing more than 7 ounces at the rate of 2½ per minute. Injection pressures up to 15,000 psi . . . compensating feed mechanism . . . automatic molding cycle . . . large platens . . . finger-tip controls . . . fast opening die-lock mechanism and minimum maintenance make the LEWIS "6" outstanding for low-cost high-speed production molding. Intricate parts formerly made on much larger machines now can be produced on Model "6" at a fraction of initial and normal operating costs. The LEWIS "6" also features the exclusive new "Hydra-Lock" clamp . . . the safest, most powerful mold clamping device available today. "Hydra-Lock" develops a 200-ton clamping pressure in tenths of a second . . . facilitates quicker, easier mold setting procedures.

Hotter'n a sheriff's pistol . . . the LEWIS "6" is your best buy in injection molding machines!

Write for BULLETIN 102 for details and specifications.

1729-LW

THE LEWIS WELDING LEWIS & ENGINEERING CORPORATION

11 Interstate Street
Bedford, Ohio

Investigate the new modified polystyrene

MC-305 is the easiest to mold of Koppers "high impact" series of Modified Polystyrenes. It has been used in such large area moldings as refrigerator door liners, air conditioning housings, and television masks and tube protectors.

MC-305's high resistance to shock and impact minimizes danger of damage to molded sections during ordinary production line handling as well as during actual use. Its shock resistant qualities also make MC-305 an excellent material for toys and novelties.

Possibly you have a product that can be made better or faster or less expensively with Koppers Modified Polystyrene. To help you choose the right Koppers material for your particular job, we have prepared a new technical bulletin detailing the properties of Koppers Modified Polystyrenes. Write today for your free copy.

KOPPERS POLYSTYRENES

Type 3	General Purpose Polystyrene
Type 7	Improved Heat Distortion Temperature
Type 8	Highest Heat Distortion Temperature
MC-185	High Impact, Lowest Water Absorption Rate
MC-301	High Impact, Improved Heat Distortion Temperature
MC-305	High Impact, Easy Flow
MC-309	High Impact, Highest Heat Distortion Temperature
MC-401	Medium Impact, Improved Heat Distortion Temperature
MC-405	Medium Impact, Easy Flow
MC-409	Medium Impact, Highest Heat Distortion Temperature

Koppers Plastics Make Many Products Better and Many Better Products Possible.

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Koppers Plastics

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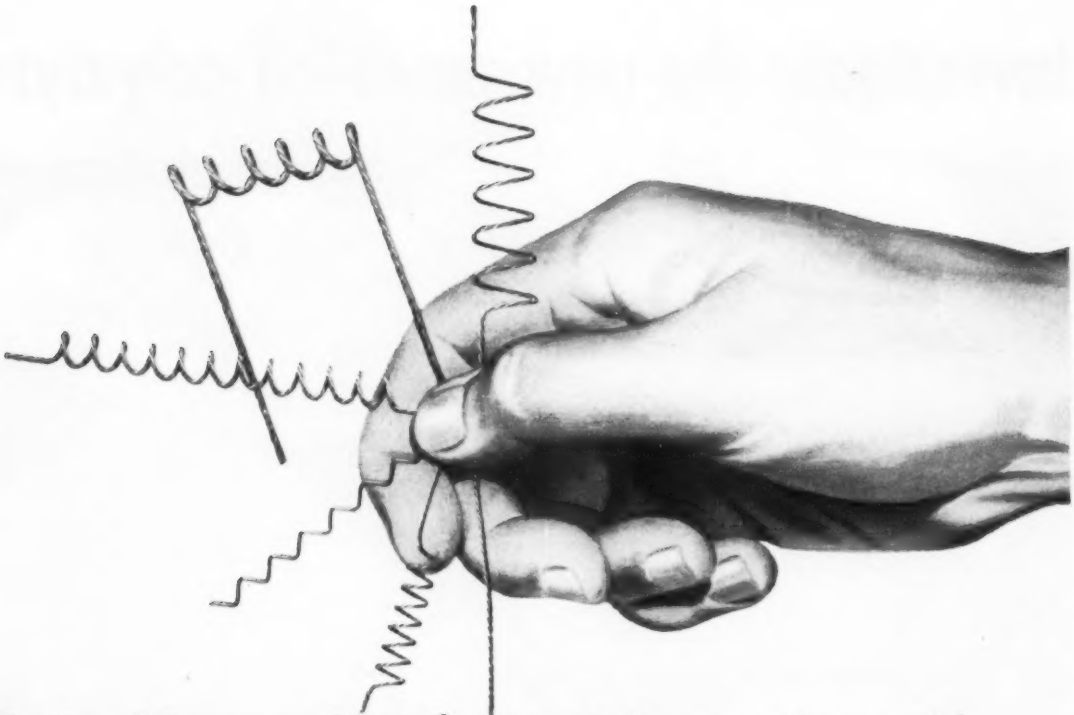

Better Vacuum Metalizing at Lower Cost with

SYLVANIA TUNGSTEN COILS

Sylvania tungsten source heater coils give you maximum performance because they're specially designed to overcome all problem conditions likely to be encountered today.

Because they are made from stranded wire, Sylvania coils have a more effective area for the retention and vaporization of the coating material. They give maximum evaporating capacity for any specific job. They assure a uniform flow of metal . . . in rate, intensity, and direction.

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Sylvania tungsten coils save you money because they actually stay on the job longer. The combination of stranding and coiling allows much greater expansion and contraction during the cycle with greatly reduced mechanical breakage . . . giving you more shots from each filament.

A complete line

Now Sylvania offers you a complete line of tungsten coils . . . each designed for a specific metalizing job. Or, if you form your own coils, Sylvania tungsten wire is yours in a full range of diameters, in stranded cable or single strands . . . quality controlled from ore to finished product.

Remember, our engineers are at your service in the solution of any vacuum metalizing problem. New illustrated folder gives valuable suggestions and shows why you'll save money and material with Sylvania's improved tungsten coils. For your free copy, address: Sylvania Electric Products Inc., Dept. 4T-2404, 1740 Broadway, New York 19, N. Y.

SYLVANIA

TUNGSTEN & CHEMICAL PRODUCTS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

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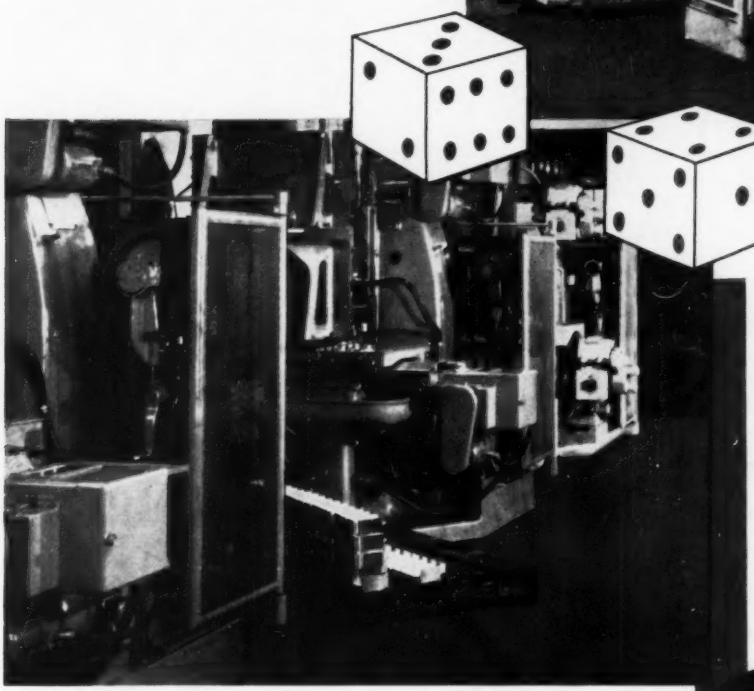


for prompt service on precision molds

from your master patterns

Clark-Aiken makes available to you the most complete facilities for production of precision duplicate molds to be found anywhere, including:

1 Single-Spindle Keller, 8 ft. x 3 ft. capacity, 3-Dimensional
1 Single-Spindle Keller, 4 ft. x 2 ft. capacity, 3-Dimensional
1 Single-Spindle Keller Profiler, 24 in. x 16 in. capacity
2 Single-Spindle Kellers, 36 in. x 20 in. cap., 3-Dimensional
2 3-Spindle Kellers, 36 in. x 10 in. center distance, 3-Dimen.

7 **NEW AC-TYPE ELECTRICALLY-CONTROLLED CONTOUR MILLING MACHINES** manned by master craftsmen working three shifts, insure prompt delivery of precision duplicate molds in any quantity from master patterns of any material.

Send prints or sample parts for prompt quotations and delivery dates

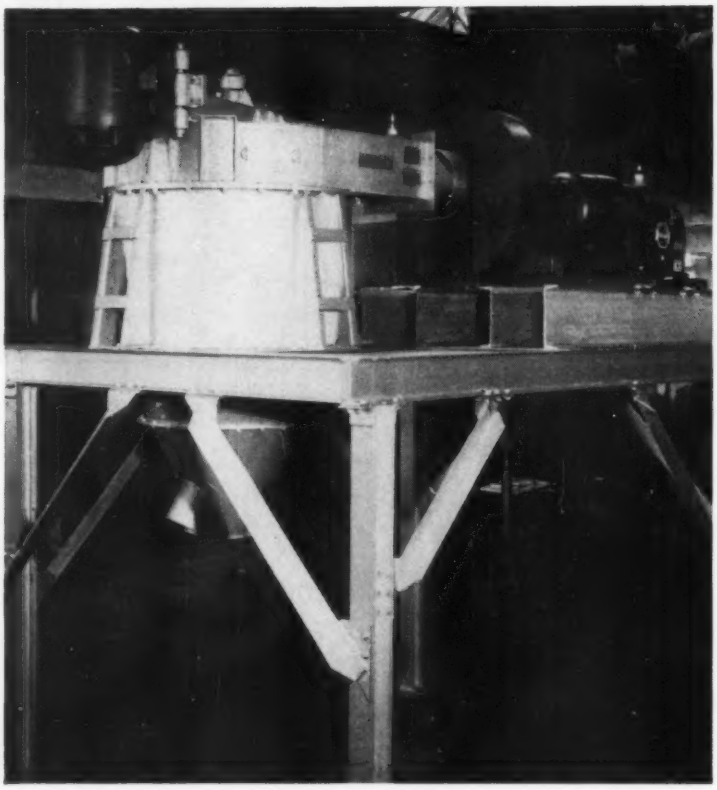
PRECISION MOLD DIVISION

Clark-Aiken COMPANY

LEE, MASSACHUSETTS

NEW TYPE STURTEVANT AIR SEPARATOR

Recovers Fines in Micron Ranges



Now the famous Sturtevant Whirlwind Air Separator, so widely used throughout industry for fast recovery of fines, has been specially designed to "pick-off" classified materials such as pigments, limestone fillers, plastics, oyster shells, etc., in micron sizes.

These highly efficient air separators select a continuously uniform product of desired fineness. Used in a closed circuit with grinding mills, they increase production, cut power costs.

Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for further information.

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Designers and Manufacturers of:
CRUSHERS • GRINDERS • SEPARATORS
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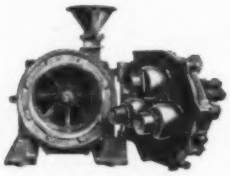
EXCAVATORS • ELEVATORS • MIXERS

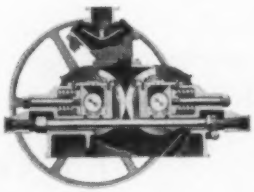
OTHER STURTEVANT EQUIPMENT

MICRONIZER® GRINDING MACHINE
A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.

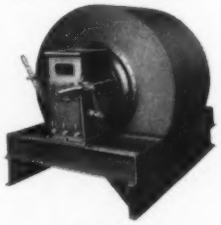
Sturtevant Micronizer grinding machines are available in many sizes and capacities.



RING-ROLL MILLS
For medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS
For granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



BLENDER
Four-way mixing action assures a thoroughly blended product. Open-door accessibility permits easy cleaning. Available in many mixing capacities for ¼-ton per hour and up.

POLYESTER RESINS SERVING INDUSTRY FOR 13 YEARS

the Story of the MELLOW YELLOW

Of course, IC POLYESTERS are good—but the user of Interchemical resins gets an EXTRA dividend in the form of a unique brand of technical service.

For instance, take the case of the manufacturer of corrugated plastic panels. There were pigments available to make beautiful translucent reds, blues, and greens, but all of the available yellows were either too muddy and opaque or lacked the necessary light-fastness.

Interchemical solved this problem with a new, clean, transparent, light-fast yellow pigment that made possible the production of a plastic corrugated sheet with soft yellow tones.

This contribution was the product of Inter-related Research, a process whereby Interchemical applies technical know-how gained in one field of endeavor to the solution of problems in another.

If you have a difficult production problem perhaps IC Inter-related Research can help find an answer. Why not ask us in?

Interchemical offers a complete line of clear and filled resins—rigid, resilient, flexible and fire retardant—as well as color concentrates providing a wide range of hues.

Interchemical Corporation

Finishes Division

Factories: Chicago, Ill. • Cincinnati, Ohio • Elizabeth, N. J. • Los Angeles, Cal. • Newark, N. J. • Mexico City, Mex.

In Canada, IC products are sold by AULCRAFT PAINTS LTD., Toronto, Ont., under its trademarks.

D.I.O.P. SCORES A HIT

More and more vinyl processors are employing di-iso-octyl phthalate as an economical and efficient plasticizer for film, sheeting, and other plastics applications.

This trend is evident in the increasing diversity of vinyl plastic products formulated with D. I. O. P. For example, plastisols made with D. I. O. P. exhibit low stable viscosities. Vinyl insulations incorporating this plasticizer possess good electrical properties. Film and sheeting plasticized with D. I. O. P. have excellent stability to heat and light.

Hercoflex 200 is Hercules' D. I. O. P. We believe you will find it a superior grade—pale in color, low in volatility, and uniform in quality, properties, and performance. It carries the Hercoflex name, backed by the years of technical and manufacturing know-how that have established this line of vinyl plasticizers.

Hercoflex 200 is readily available, and priced for today's market. We welcome your inquiries on price and delivery data, or for further technical information.

HERCOFLEX® VINYL PLASTICIZERS

- **150** (di-N-octyl, decyl phthalate)
- **200** (di-iso-octyl phthalate)
- **290** (di-N-octyl, decyl adipate)

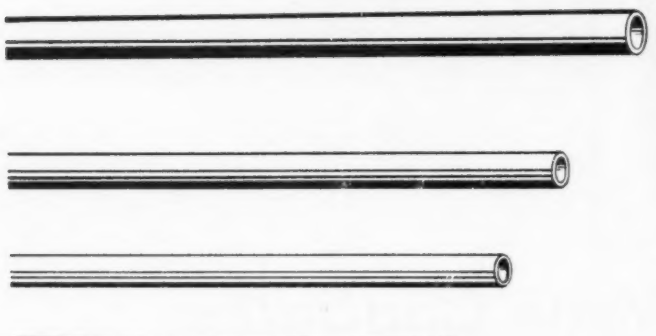
SM54.1

HERCULES POWDER COMPANY INCORPORATED *Synthetics Department*

916 Market Street, Wilmington 99, Del.

By courtesy of Messrs. L. M. P. Torino—Italy. Patented by Mr. Guareschi

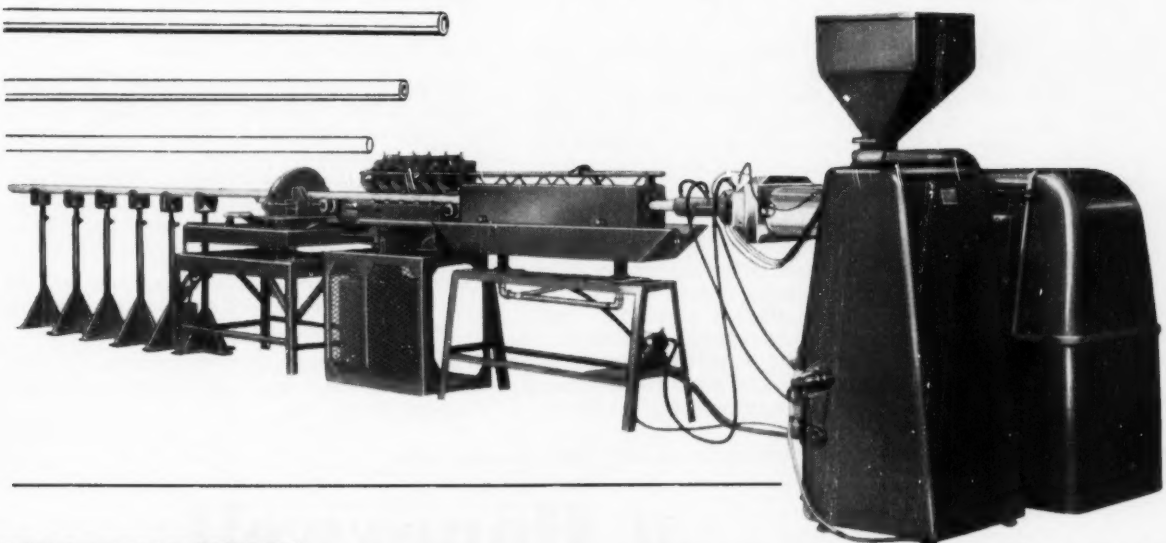
P.V.C. PIPE EXTRUSION UNIT



Rigid pipe, because of growing demand, has inspired a substantial number of installations of *WINDSOR* extruders.

This unit produces pipe up to 4" diameter and in any required length.

Write for full information.



R.H. WINDSOR LTD

LEATHERHEAD ROAD • SOUTH CHESSINGTON • SURREY • ENGLAND

EXCLUSIVE U.S.A. REPRESENTATIVE: F. J. Stokes Machine Company, Philadelphia 20, Pennsylvania.
EXCLUSIVE CANADIAN REPRESENTATIVE: Wilmod Company, Plastics Division, 2488 Dufferin St., Toronto.

Here's the accurate, economical way to control extruder temperatures

Five heating zones of Royle "Spirod" plastic extruder are controlled by ***Pyr-O-Vane*** *instruments on integrally-mounted panel.*

. . . the *Pyr-O-Vane* Controller

EXTRUDER temperatures stay within tight tolerances, when *Pyr-O-Vane* controllers are on the job. In the "Spirod" extruder manufactured by John Royle and Sons, for example, five of these instruments work together in a multi-zone control system that gives excellent accuracy and reproducibility of machine temperatures.

Pyr-O-Vane controllers provide all the accuracy any plastic-working machine could require. Their high resistance measuring system is practically unaffected by length of lead wires. The snap-action control gives razor-sharp sensitivity . . . and incorporates a special anticipator circuit that minimizes cycling above or below the set point. For applications requiring proportional control, *Electr-O-Pulse* control is supplied.

Maintenance men appreciate the simple plug-in design of this controller. The complete system can be removed and replaced in only a few seconds. And the instrument's moderate price places high-quality control within the reach of any application. The *Pyr-O-Vane* controller is readily applicable to extruders, injection molders and plastic-working machines of all types.

Your nearby Honeywell sales engineer will be glad to discuss your specific control applications . . . and he's as near as your phone.

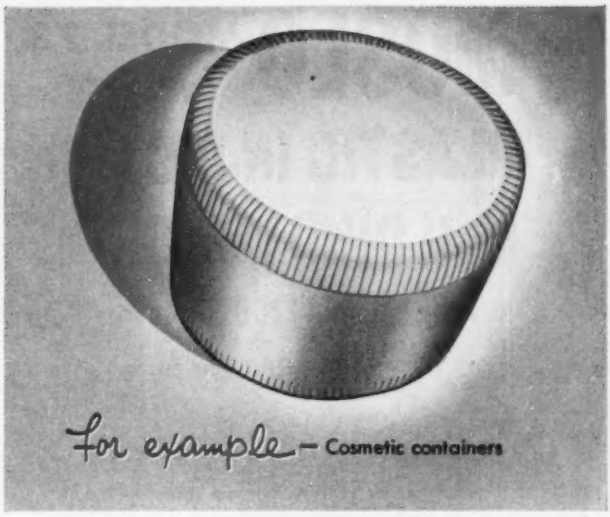
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Catalog 1053, "*Pyr-O-Vane* Controllers."**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

For precision and versatility—choose
OWENS-ILLINOIS for PLASTICS

for example—
Fitments for glass containers—(metal or plastic closure and glass container all by Owens-Illinois)



for example— Cosmetic containers

for example—
Fitments for metal containers

for example— Tablet containers

Owens-Illinois packaging know-how and high-quality standards offer you the *finest* in molding plastic facilities . . . Injection molding . . . Compression molding . . . A complete range in plastics for packaging, for specialties.

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PRECISION PLASTICS
AN (I) PRODUCT

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GENERAL OFFICES • TOLEDO 1, OHIO

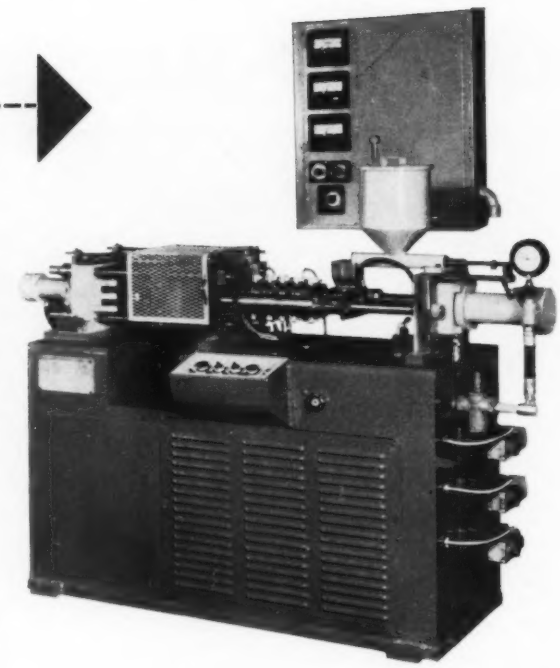
Introducing the New

MOSLO MODEL 73 ..Two Ounce.. PLASTIC INJECTION MOLDING MACHINE

★ High Speed—1200 Shots Per Hour

★ Completely Automatic

★ Hydraulic Operated



★ Here is the answer to high-speed injection molding at a low mold cost. The Moslo Model 73 is a sensational, all-new, plastic molding machine—revolutionary in design, outstanding in performance. It incorporates the most recent engineering advancements in completely automatic injection molding. Rated at 1200 cycles per hour (dry run) it will shoot a full two ounce shot. The Model 73 is comprised of two separate units—the beautiful, compact machine and a sturdy, easily accessible, wall mounted control cabinet. Ideal for long runs of small pieces at high speed operation, plus small mold cost, the Model 73 is just the machine that custom molders have been wanting.

Compare these features, investigate, and you'll buy!

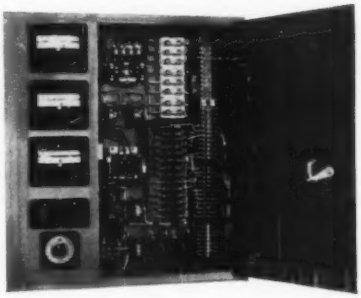
THE MODEL 73 MOLDING MACHINE FEATURES . . .

- Horizontal Construction
- Four tie rods with micrometer adjusting nuts for even distribution of pressure on four points of toggle clamp
- Welded base of heavy-gauge steel
- 45 gallon oil tank
- 5 H.P. motor
- Vickers hydraulic pump and heavy-duty oil heat exchanger
- Two pressure hydraulic system so if part is not ejected machine shuts down without damaging mold
- 25 pound per hour plasticizing capacity
- Adjustable control injection speed
- 14 pound capacity metered-type hopper
- 8 x 9 inch DME mold blanks are employed
- 20 square inch *plus* molding area
- Water-cooled injection piston plus top half of material receiving funnel
- Even heat distribution and flow of material obtained with Moslo 'Radee' torpedoless stainless-steel material cylinder
- Cushioned hydraulic action at end of the forward and reverse strokes of clamping cylinder—parts ejected gently
- When safety gate is open, mold automatically opens—protecting operator and mold
- Push button panel on machine contains automatic and manual controls

Both the control panel and machine are shipped complete and ready for immediate installation.

The Model 73 is manufactured entirely in the United States using standard electrical equipment and controls that are readily serviced in major cities.

The Model 73 Control Panel Features . . .



- Independently fused circuits for all controls, the motor, and the heating cylinder
- All wiring is color-coded and properly marked
- 3 West Instrument Company Gardsman proportioning instruments: one controls rear heat, one controls front heat, and one controls nozzle temperature
- Four timers for controlling the time cycle, one Cycle-Flex timer for over-all cycle, one Cycle-Flex timer for first injection stroke, one Micro-Flex Counter timer for stuffing and one Allen-Bradley Repeat Cycle timer for fully automatic operation.

PLACE YOUR ORDER NOW FOR EARLY DELIVERY

MOSLO MACHINERY COMPANY

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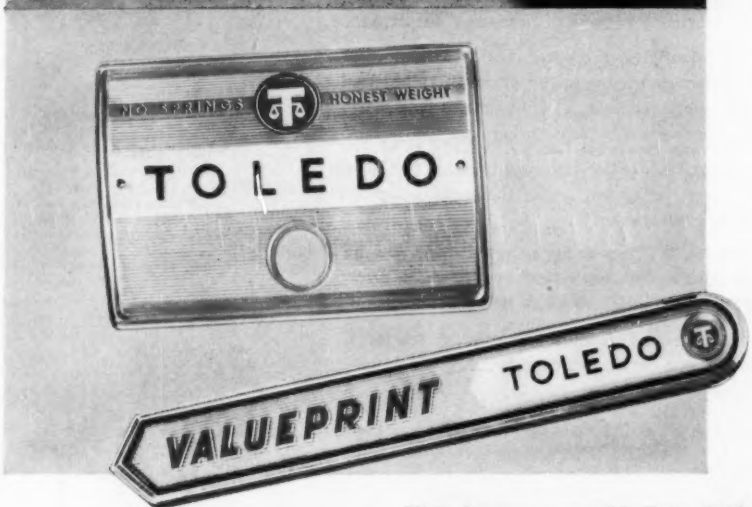
AN *Honest Weigh* TO ATTRACT CUSTOMERS . . .



with three dimensional *plastics* by

ERIE

Custom Molded Plastics

Toledo Scale Company frames the "customer's window" on their new Guardian "70" Duplex Scale and also identifies their new Valueprint Prepackaging Scale with a beautiful three dimensional plastic plate in crystal, white, silver, and red — an eye-compelling magnet that enhances the beauty of these modern food store machines.

ERIE is helping hundreds of manufacturers to add sales appeal to their products with functional parts that combine gleaming beauty with utility; and with sparkling three dimensional trademarks and name plates that make the company's identification an outstanding symbol of quality that stimulates the owner's pride of possession.

ERIE has complete facilities for the execution of your order, from mold design to precision molding, foiling, spraying, drilling and packaging.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

ERIE TRADE MARK

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

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announcing "KNITKOTE"...

the perfected knit backing that adds SPRING to vinyl coating

You will find Wellington Sears superb new KnitKote* fabrics have two vital distinctions. These cotton knits have been specifically designed as backings. And they represent *perfected* performance.

KnitKote supplies vital elasticity to coated fabrics with perfect shape retention. Its resiliency means a lighter, suppler finished material with a better hand—a material that makes it easier to apply, with a consequent reduction in cost factors.

For these excellent reasons KnitKote is a natural for upholstery, both furniture and automotive, as well as for the rapidly expanding field of simulated leather outerwear.

With these KnitKote fabrics, Wellington Sears now brings you the single complete collection of backing fabrics—from woven cotton and synthetic fabrics of every description through non-woven backings.

If you believe in the spectacular potential of knit fabrics for coating—and the importance of proven quality in *all* backings—please see us at Wellington Sears.

Superior Performance in a Complete Line of Backings.

Tests show that finished materials backed with KnitKote stretch up to 50% in width, and at least 10% in length. This improves the wear of upholstery fabrics.

Since lighter weights are possible with KnitKote, costs are competitive. Coated material has a better hand . . . it's less "boardy" . . . easier to tailor.

*Trade Mark

Wellington Sears

WELLINGTON SEARS CO., 65 Worth Street, New York 13

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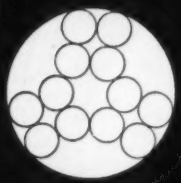
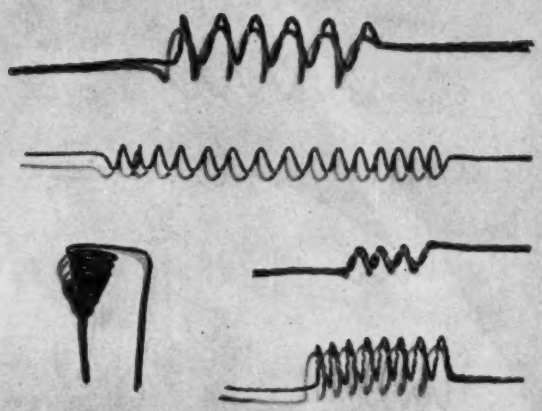
VAPORITE* stranded filaments

increase vacuum metalizing radiation as much as 170%

ORDINARY SINGLE FILAMENT



3X4 STRANDED FILAMENT 170% GREATER RADIATION EFFECTIVENESS



VAPORITE* stranded filaments were developed by engineers of Bergen Wire Rope Company and introduced to the trade in 1948. By using a number of strands of small diameter wire instead of a single strand the exposed surface area can be increased tremendously with resulting higher evaporating capacity — more rapid evaporating rate—longer life. Vacuum metalizing efficiency is greatly improved with less time out for broken filaments and lower overall metalizing costs.

VAPORITE* stranded filaments are available in a wide range of sizes and constructions for use with any metal and under widely varied operating conditions.

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CUT LENGTHS AND FINISHED COILS

For Maximum Vacuum Metalizing Economy
Specify **VAPORITE*** Stranded Filaments

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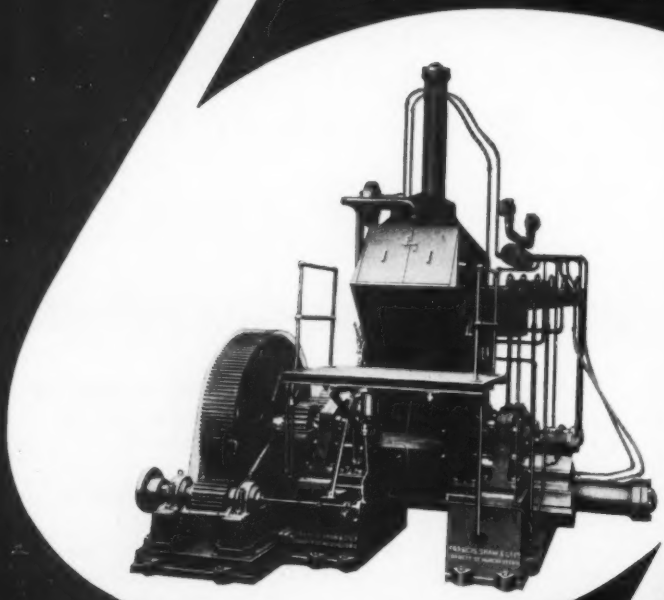

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THE MODERN ENCLOSED MIXING MACHINE

The Shaw Intermix compounds natural and synthetic rubber at lower temperatures than usual with other internal mixers, yet it can also be steam heated for dealing with plastics and similar substances

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If they are the "old time" mold and die makers, they have probably gone to Phoenix, Arizona to enjoy retirement in the wonderful Phoenix climate. And chances are that after a few months of fun-in-the-sun, they are anxious to get back to work and turn their hands once again to their old skills.

That's why Phoenix is today one of the great centers of skilled mold and die makers — men who are still able to turn out a full day of careful and exacting work — men who take justified pride in the skills they've acquired in a lifetime of work and experience.

That's why Phoenix was selected as the site of operations for BEE Mold and Die, Inc. — custom-manufacturers of molds and dies. For BEE knows that only the superior abilities of these experienced craftsmen can produce the perfectly made molds and dies that you demand.

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BEE Mold and Die, Inc., meets the needs of rubber, plastics and metal casting industries by providing them with a dependable source of molds and dies accurately made to the most exacting specifications.

BEE is devoted exclusively to the custom-manufacturing of molds and dies — their entire effort is devoted to this single task—they do nothing but design and produce molds and dies for you — they have no other interests.

BEE operations are thoroughly integrated and subject to minute control. For example, they even do their own engraving.

BEE provides you with the services of the most modern equipment *plus* the services of capable engineers and skilled craftsmen — you can be assured of guaranteed quality and workmanship in the production of your molds and dies.

Take your next mold or die problem to BEE for fast, dependable and economical service. We ship *F.O.B. your plant.*

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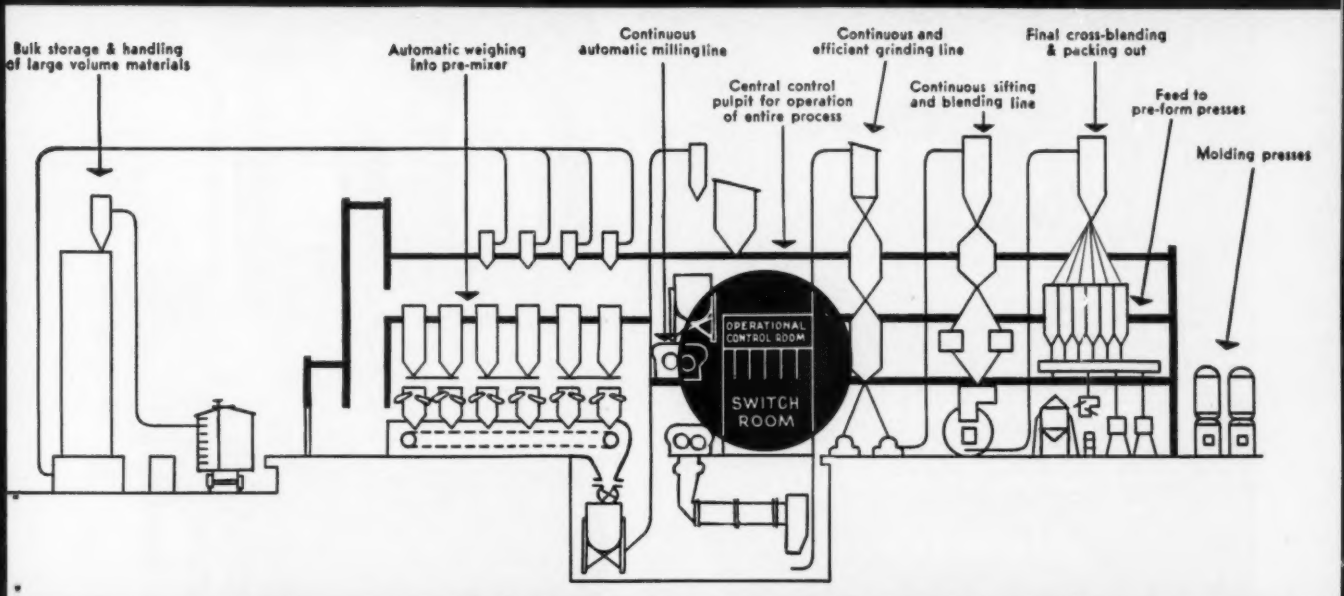
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Central control pulpit for operation of entire process
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OPERATIONAL CONTROL ROOM
SWITCH ROOM

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It is one of the many current projects on our boards . . . for example: A Tire Manufacturing Plant; a Process for Manufacturing Plastic Pipe; a Compounding System and Mill Room for Mechanical Rubber Goods Plant.

The combination of Hale and Kullgren, Inc., and The Aetna-Standard Engineering Company offers a complete service to the rubber and plastics industry. We are equipped to deliver a complete plant, a specialized process, engineering service or individual machines for processing rubber and plastics.

Address your inquiry to Hale and Kullgren, Inc., P. O. Box 1231, Akron, Ohio. Give us an outline of your needs and we will give you prompt and authentic information.

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a complete plant : a specialized process : an engineering service or individual machines

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This old and well-known line of machinery was acquired March 1, 1952, by The Aetna-Standard Engineering Company. They are manufactured in their Warren, Ohio, and Ellwood City, Pa., plants. The sales and engineering of the National Erie line is the responsibility of Hale and Kullgren, Inc., Akron, O.

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Plants in Warren, Ohio
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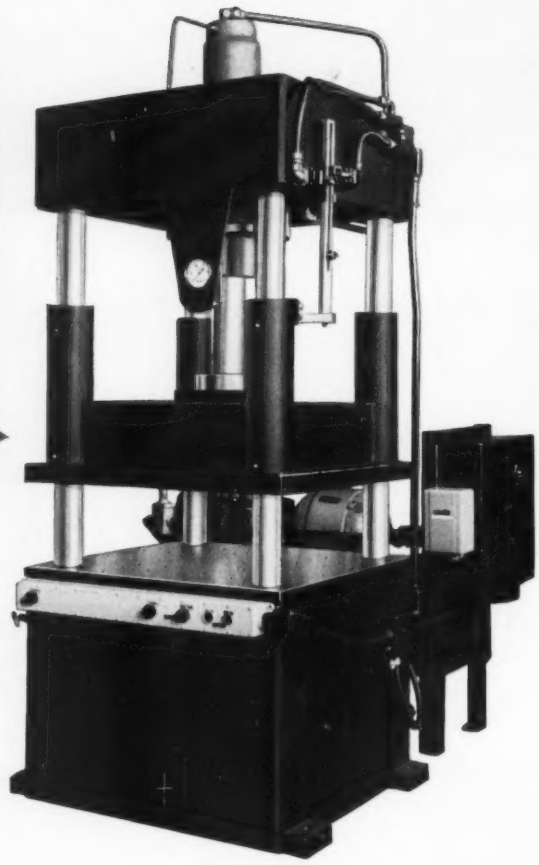
DAKE GUIDED PLATEN PRESS

for molding reinforced plastics



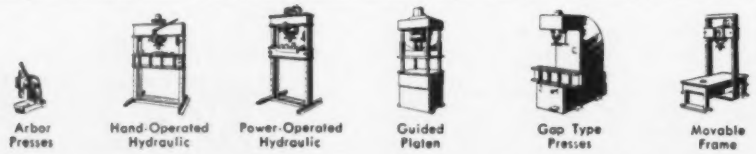
Dake Plastics Presses are engineered to the requirements for compression molding of reinforced plastics. Above is illustrated a 75-ton, 4-post double-acting guided platen press, electrically powered and hydraulically operated.

Standard Dake Plastics Presses are equipped with automatic controls which can be arranged so that the ram advances quickly almost to contact—then advances under full power until exactly the desired pressure is exerted on the mold. This pressure is maintained steadily throughout the curing cycle (time interval may be adjusted), after which it is released automatically and the ram returns to starting position.

Dake Guided Platen Presses for plastics molding can be engineered to your particular requirements. They are available in capacities up to 300 tons. We will gladly work with you in developing the molding press you need. A letter or phone call will put us to work.

Dake Engine Company, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES



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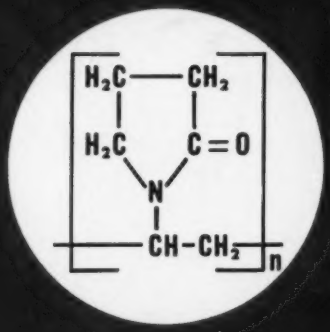

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unique combination of properties

- binds and stabilizes many organic and inorganic compounds
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- detoxifies a wide variety of poisons, toxins and irritants
- protects and stabilizes suspensions, dispersions and emulsions
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- prevents soil redisposition
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- pharmaceutical (plasma expander, detoxifier, drug vehicle and retardant, tablet binder, etc.)
- chemical (protective colloid for polymerization and other chemical reactions)
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- food (stabilizer, thickener, flavor improver,etc.)
- detergent (soil suspension, detoxifier, etc.)
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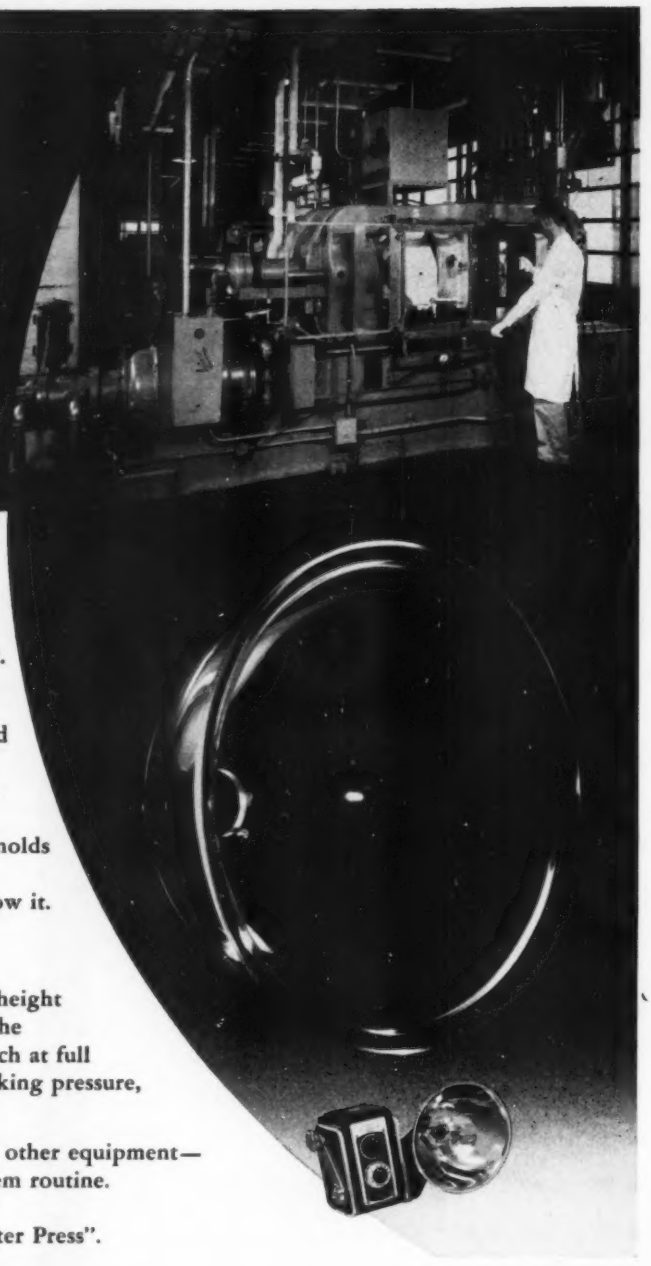
kodak's new reflectors

*BREATHE *in a* LESTER



See that part? It's being molded on a 20 ounce Lester at Eastman-Kodak in Rochester, New York.

There's a ticklish molding problem involved:

This butyrate part, with a fairly large projected area, has a 3/16" x 1/4" bead running around the rim. To fill it properly, Kodak must use heated molds, meaning extremely molten material at the parting line. Despite this, the molds had to be *vented* without a trace of flash—the subsequent plating operation wouldn't allow it. How do you lick a problem like that? Easily, *with central die height adjustment.*

***On a Lester, with the patented single screw die height adjustment, with a twist of the wrist you can set the molds to open a fraction of a thousandth of an inch at full clamp—taking complete advantage of the full locking pressure, and still getting "metered breathing" or venting.**

On routine molding jobs, Lesters will outproduce other equipment—on tough jobs like this, the Lesters make them seem routine. Write for complete machine specifications and ask for the Lester-Phoenix house organ, "The Lester Press".

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Ionol is colorless, tasteless, nontoxic, non-coloring and stable . . . qualities that recommend it especially for use in plastic peels, films, food wrappings and similar products. It does not color with age, nor does it affect dyes and pigments in plastics.

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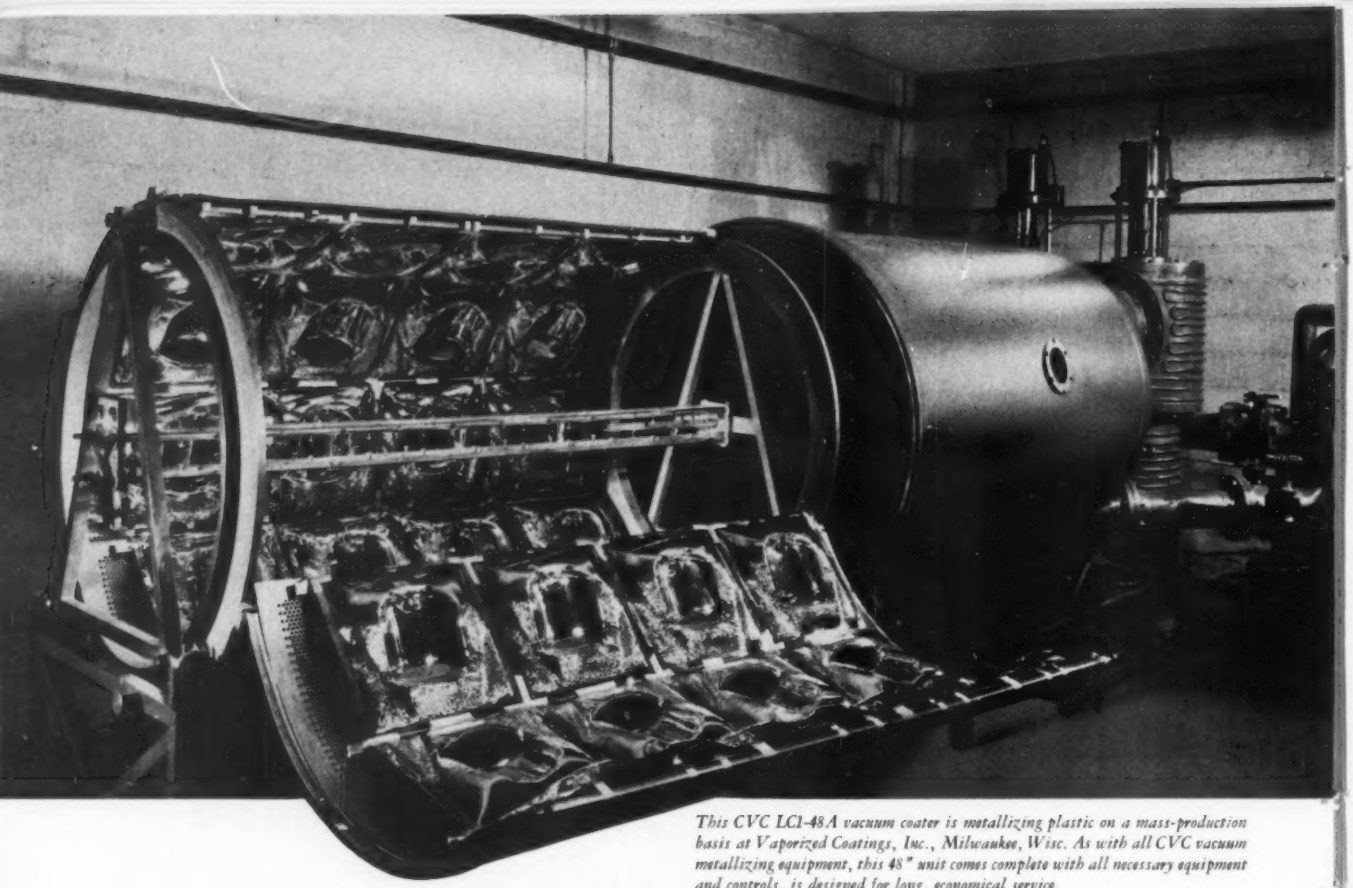

This CVC LC1-48A vacuum coater is metallizing plastic on a mass-production basis at Vaporized Coatings, Inc., Milwaukee, Wisc. As with all CVC vacuum metallizing equipment, this 48" unit comes complete with all necessary equipment and controls, is designed for long, economical service.

Large plastic pieces get a shine with CVC high vacuum metallizing

IF you've been wondering how a sales-compelling metallic mirrored surface can be produced on your large formed or molded plastic pieces, *CVC* has the answer—high vacuum metallization. And it's easy and economical with a *CVC Vacuum Coater.*

The large pieces are loaded on an extra long cylindrical fixture which opens to permit easy attachment at a convenient working level.

The entire fixture is rolled into the vacuum chamber, electrical connections are made, the door closed, and, in a matter of minutes, the load is coated with aluminum. Three cycles per hour are easy, four are possible.

All that remains to complete the operation is a paint or lacquer overcoat to protect the metal film.

Gold, copper, or other colors can be applied by coating the surface to be metallized with a tinted lacquer *before* metallizing.

Let *CVC* show you how to make more profit faster using high vacuum metallizing on large plastic pieces.

Consolidated Vacuum Corporation, Rochester 3, N. Y. (a subsidiary of Consolidated Engineering Corporation, Pasadena, California).

CVC

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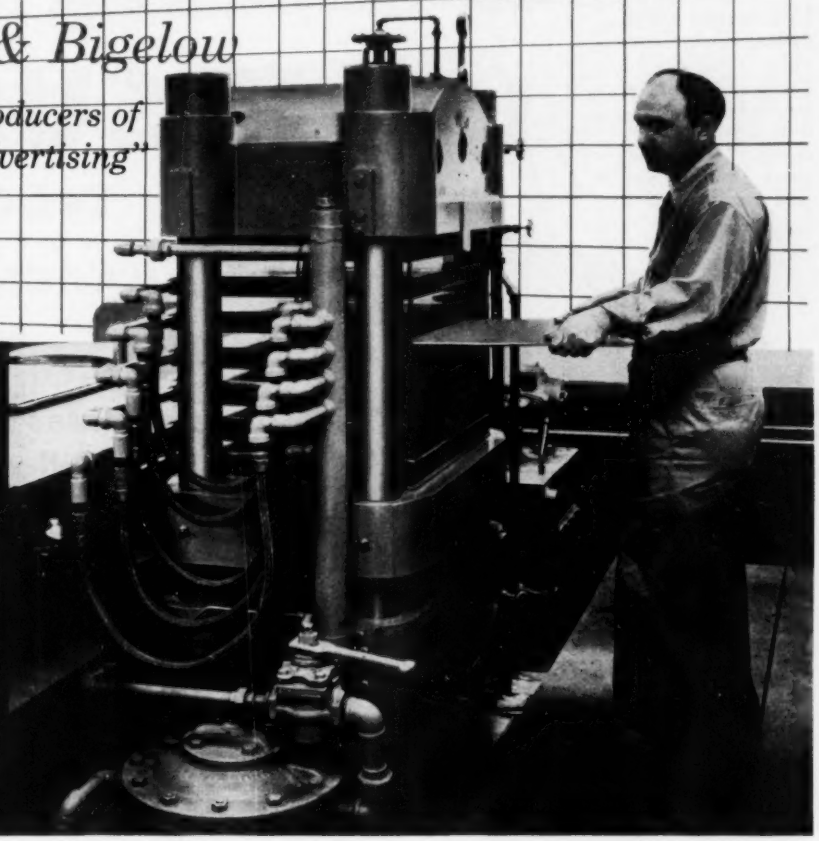

LAMINATING PRESS

This Elmes® Press at Brown & Bigelow is a 150-Ton, 4-column Moving-Up Type Multiple Opening Laminating Press, with steam-heated hot plates and flexible connections. Press has six 1⅜" openings . . . steam-plate size 28" L to R x 22" F to B . . . stroke 9½" . . . hand lever operated.

The Elmes Press pictured above is used in the processing of calendar cards, blotters, plastic rulers and for laminating cards at the Brown & Bigelow East Hennepin Plant. It is a typical example of the complete line of compression type presses manufactured by Elmes—presses used in curing high-pressure individual sheets and decorative laminates.

Steam-heated "hot plates" are made from 2" up to 4" thick, depending upon the particular press. Since the platens of multiple platen laminating presses must be heated and cooled, they are cored for circulation of steam and cooling water. Flexibility of steam and water lines, required by the movement of platens, is provided by flexible hose connecting to a main pipe header.

In the pressing operation, a stainless steel caul plate is used on either side of the stack of treated material. Several stacks, separated by caul plates, may be loaded between each two steam platens of the press.

A formal proposal to suit your particular requirements, or further information, will be promptly supplied on request. Get in touch with your Elmes distributor or write to us direct.

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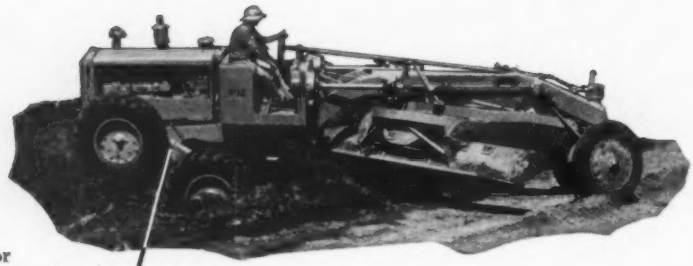
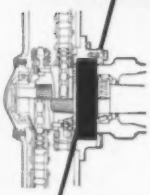


This rugged motor grader, made by Caterpillar Tractor Co., Peoria, Illinois, features a tandem-swing drive in its rear wheel design which gives it great traction and grade accommodation.



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Graphited plastic laminate eliminates sleeve trouble in "Caterpillar" Motor Grader

On their Motor Grader tandem-drive housing pivot bearings, Caterpillar Tractor Co. experienced premature sleeve bearing wear. These bearings are subjected to intermittent oscillating motion and are difficult to lubricate. Field reports showed that metal sleeves became scored after only 300 to 600 hours of operation.

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In hundreds of similar applications, laminated and molded INSUROK made by The Richardson Company are solving difficult problems for industry. Investigate these materials, today.

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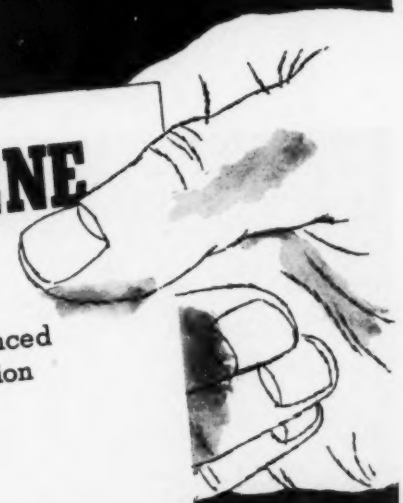

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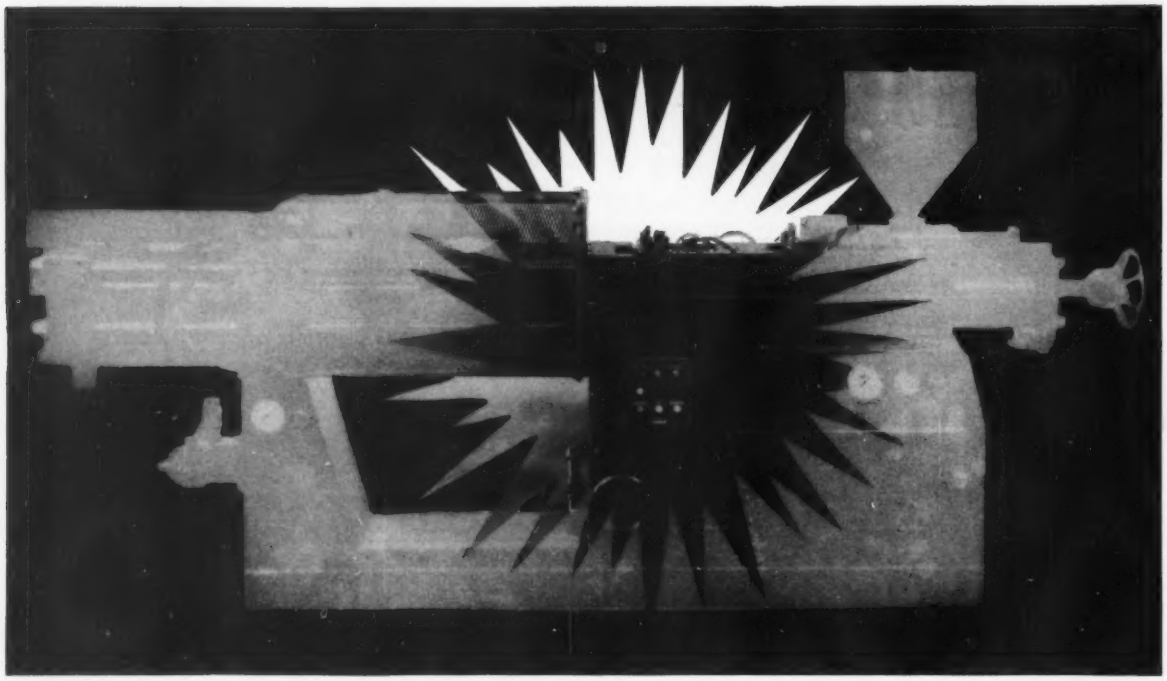

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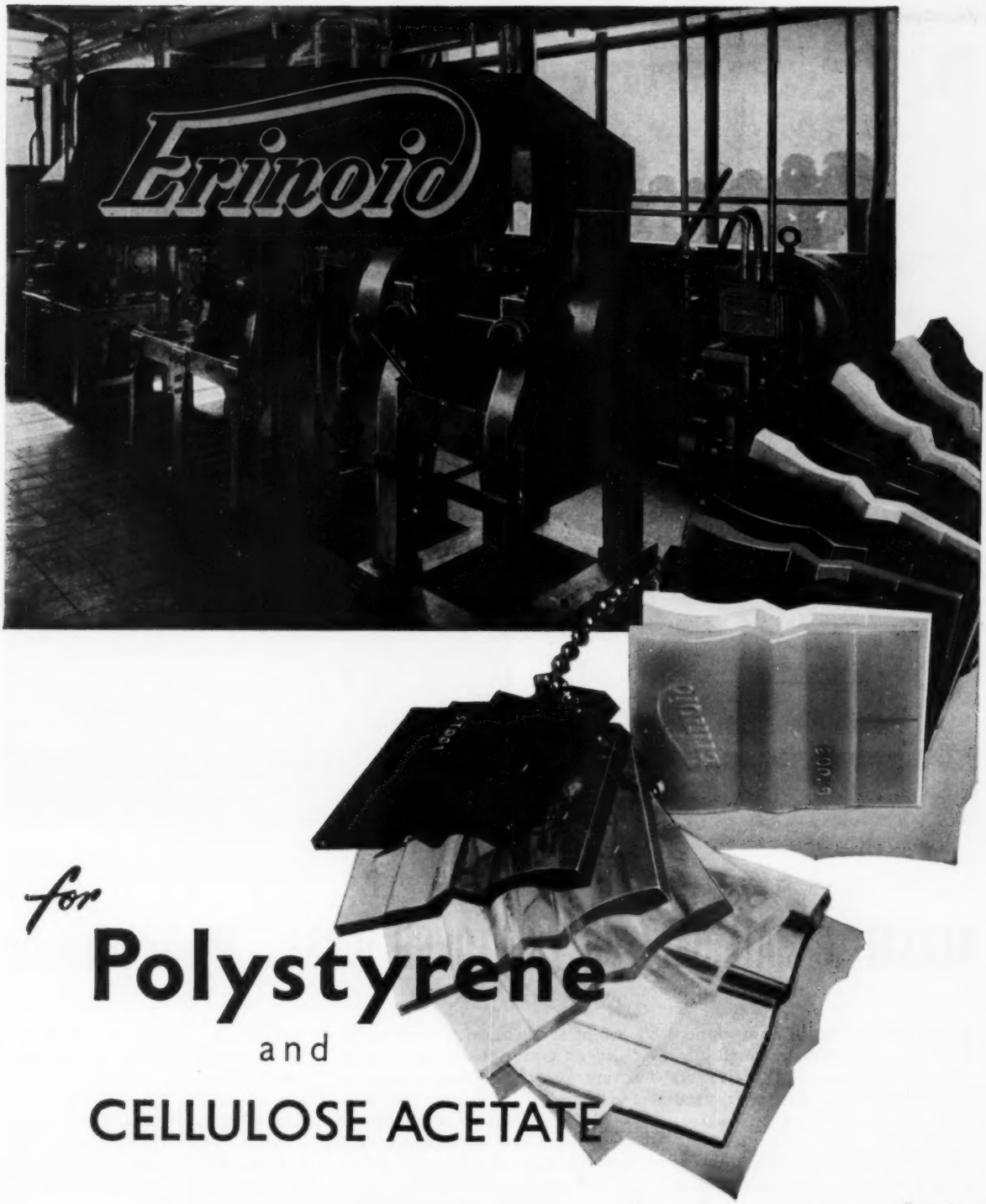

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VERSATILE MATERIAL FOR THE TOUGH JOBS!...Hycar phenolic

HYCAR-phenolic compounds are used for many tough jobs in many industries. The application pictured here is a float shoe, used in oil well work. The float shoe seat is made of Hycar and phenolic resin. It seals tightly against extreme pressures encountered in running long strings of pipe. It resists the cutting action of abrasive cement slurry and again seals tightly after cement is placed. It withstands high bottom hole temperatures in the 350-400° F. range.

Compounds based on Hycar-phenolic resins are noted for their many advantages. In addition to heat, oil and chemical resistance, they possess better resistance to shock, vibration and fatigue than ordinary rigid materials. In processing, they provide good molding characteristics . . . easy flow in the mold. Designers are finding more and more uses for these versatile compounds.

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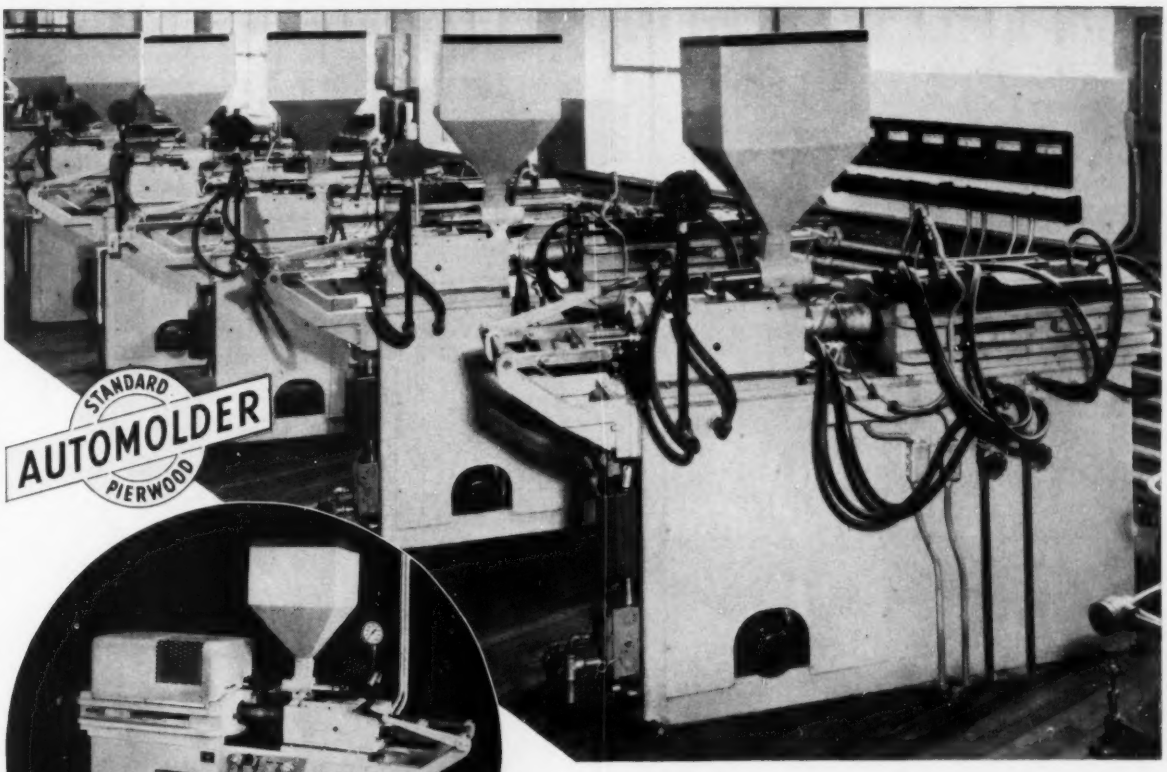

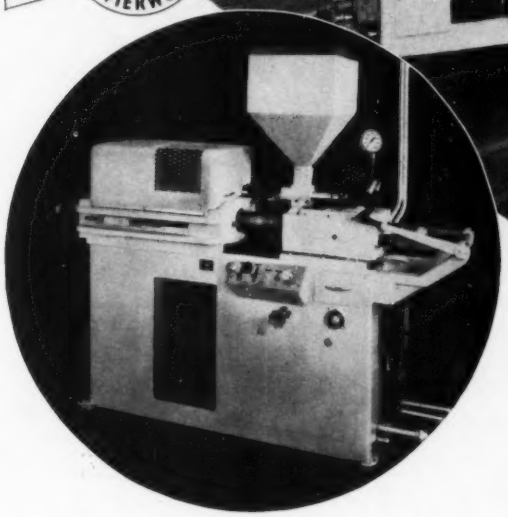

Photos Courtesy Queen Products, Providence, R.I.

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MODERN PLASTICS

APRIL 1954 VOLUME 31 NUMBER 8

Courtesy RCA Victor

Printed circuits on plastics laminates are key factors in the drive toward automation in electronic manufacturing

MUCH-PUBLICIZED predictions of the use of automation in the electrical and electronic products factory of the future are based on a single and fairly recent development: printed circuitry.

In turn, successful printed circuitry depends on plastics laminates of various kinds.

The science, which in application to production is only a few years old, has developed so rapidly that already it has had a marked effect on the size, design, simplicity, ruggedness, dependability, and cost of every item to which it has been applied. And it has already been applied to radio, television, electronic computers, test instruments, industrial control units, servo mechanisms, guided missiles, and home appliances, with more undoubtedly to come.

Indeed, progress has been so rapid in the past three years (see MODERN PLASTICS, August 1951, p. 99) that most conservative authorities foresee the completion of the revolution of production automation based on printed circuitry by 1957. Before that happens, millions of dollars will be

Dip Soldering – Printing Resistors

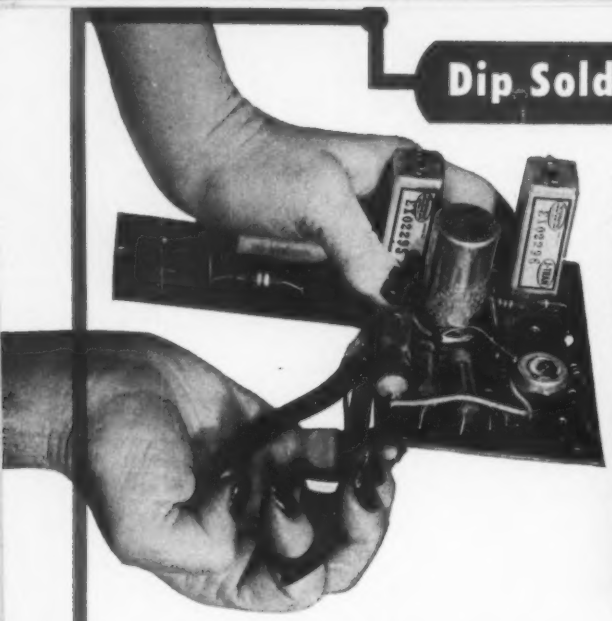
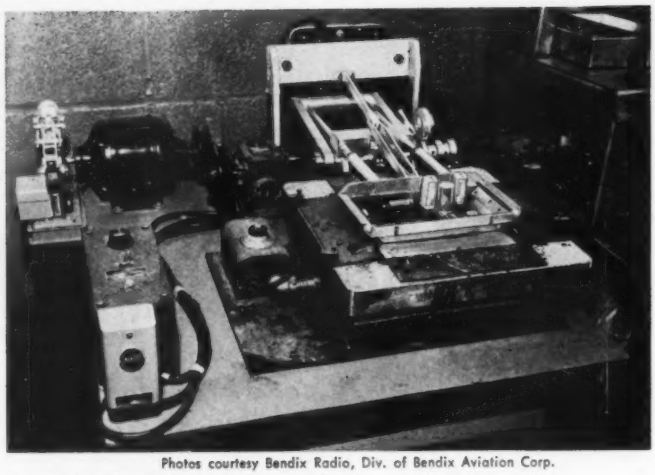
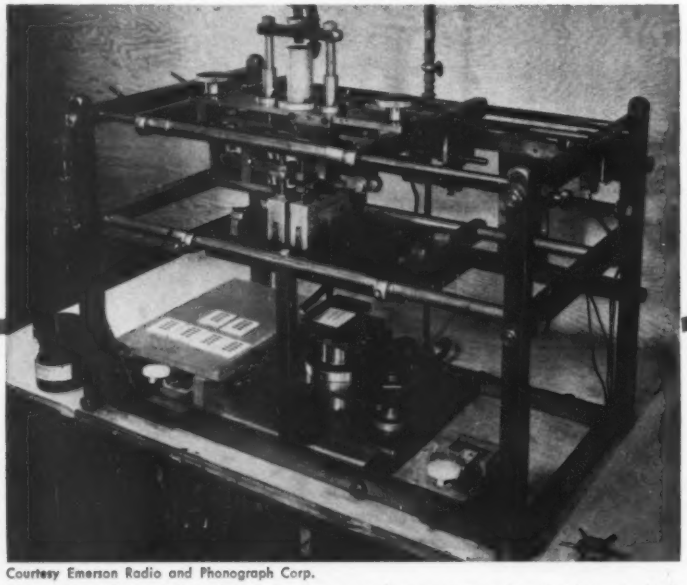


Fig. 1—Preparatory to dip soldering, component leads are cut to length and crimped with special pliers



Photos courtesy Bendix Radio, Div. of Bendix Aviation Corp.

Fig. 2—In dip soldering, circuitry is placed in holder above solder bath, lowered into it for predetermined time when button is pressed



Courtesy Emerson Radio and Phonograph Corp.

Fig. 3—Semi-automatic unit prints resistors so they connect with printed circuit. Light panel in center is about to be imprinted, six panels at left are completed

spent on the creation of techniques and equipment for automatic assembly of components for practically every piece and type of electrical equipment presently handwired. And when it does happen, the economic impact will be terrific.

Methods of Manufacture

To put a wire-replacing printed circuit on a piece of plastics laminate, any one of at least five methods may be used:

1) Metal spraying through a mask or stencil.

2) Printing with a conductive ink, then building up by electroplating if necessary.

3) Embossing or stamping a metal foil pattern on to the surface of a plastic laminate.

4) Pressing a silver pattern into plastic laminate with a heated die.

5) Surfacing the laminate with metal and etching off all but the circuit.

Method number 5 is the most widely used today, having extreme flexibility of use and considerable cost advantage. On pp. 94-95 is presented a detailed description of making etched circuits.

No matter how the printed circuit itself is made, to date components are manually hooked up to the circuit and made permanent by dip-soldering, which is a unique method for joining a multiplicity of terminals in one operation. This is probably one of the most important parts of the art of printed circuitry from the standpoint of labor savings and assurance of trouble-free joints.

To dip-solder, the various components are assembled in their proper location with the electrical leads from each component protruding through holes in the plastic laminate and the printed circuitry. The leads are trimmed to the desired short length and the end of each lead is crimped so that it will be held in position. After fluxing the printed circuitry and protruding component leads manually, the usual procedure is to float the panel on the surface of a molten solder bath. This operation produces perfect and uniform soldering connections at every point desired. One of the big advantages of the plastic laminates used is that they will withstand the high temperatures of the molten soldering bath with no deleterious effect.

Bendix Radio, Div. of Bendix Avia-

tion Corp., Baltimore, Md., has developed a semi-automatic piece of equipment for performing the dip soldering operation. Figure 1 shows an operator trimming the component leads to the required length with a special pair of pliers which not only cuts the leads but also crimps them at the same time. The complete assembly is then placed in a soldering mask which is put into the jig of the special dip-soldering machine.

Figure 2 shows the essential details of this new piece of equipment. The holding fixture of the machine is above the solder bath while the circuitry to be soldered is placed in position. Pressing a starting button lowers the assembly into the bath where it remains for a predetermined length of time. In order to assure good sweating of the solder to the joints, the fixture is oscillated back and forth in the bath and at the same time is caused to vibrate at a comparatively high frequency. After the required time has elapsed, the vibration and oscillation ceases and the soldered fixture is raised out of the bath.

The direction of all industry toward automation is based, of course, on the possibility of automatically positioning the components on printed circuits—and of even printing the components.

The Obvious Trend

Every big name in radio, television, and industrial electronics is involved in the rising use of circuits printed on plastics. Philco, Motorola, Admiral, Hallicrafters, are all now making one or more models of AC-DC receivers incorporating printed circuitry. By the time this article is published at least two new small radios built around printed circuits will be marketed at a price much lower than could be met by hand-wired units.

Not only is the labor cost in a set lowered, but trouble shooting necessitated by poor connections should be completely eliminated.

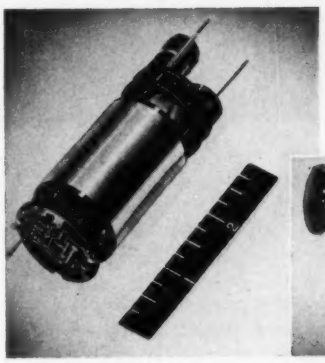
An authority in the Signal Corps has stated that a major portion of artillery ammunition now being contemplated will make use of electronic "gear." This means printed circuitry as well as automatic assembly of all electronic components. General Electric Co. now has such a system under development for the Signal Corps. It uses printed circuitry and standard components such as resistors, capacitors, transistors, and subminiature tubes. The final system, scheduled for completion in 1955, will provide for preparation and testing of components, for transporting them to the assembly machines, and for soldering and testing the completed assemblies. The present aim of this project is not to produce completed products such as radar or television sets, but to produce printed circuit sub-assemblies which will be manually combined into the completed products.

Printed Resistors

Emerson Radio and Phonograph Corp. is approaching printed circuitry in a somewhat different manner. For example, part of a research program now under way may well lead to the automatic printing of resistors in printed circuitry. Figure 3 shows a semi-automatic unit for doing this job. The square panel in the center of the photograph has the printed wiring in place on its upper surface; resistors are about to be printed in position. The six boards at the left have all been printed in such a manner that the resistors contact the proper portions of the circuit.

The ink used in resistor printing may be graphite or metallic powder used in combination with a thermo-setting resin binder. Inorganic fillers and solvents are also used to obtain good printability. Resistors are usually printed to a value approximately

Signal Corps



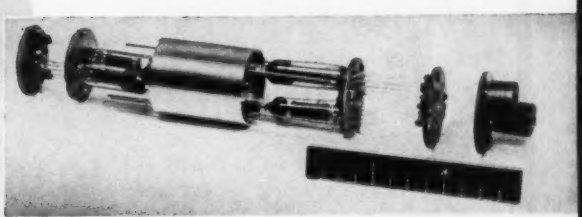
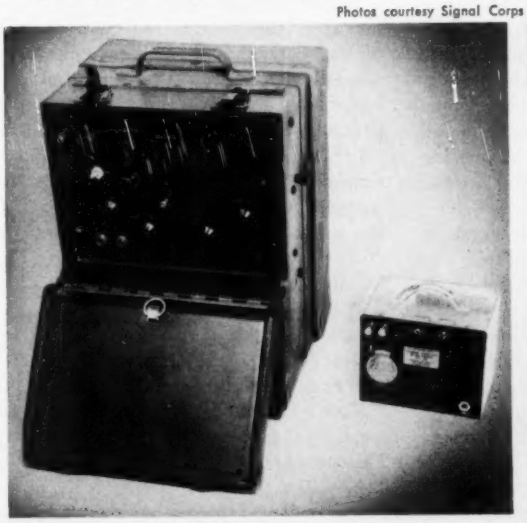


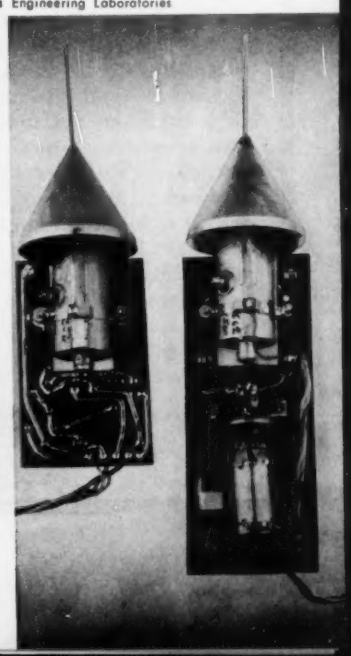
Fig. 4 (left)—Printed circuits and dip soldering techniques made possible the successful development of this compact crystal controlled radio receiver
Fig. 5 (right)—Exploded view shows disks of printed circuits dip soldered to respective components

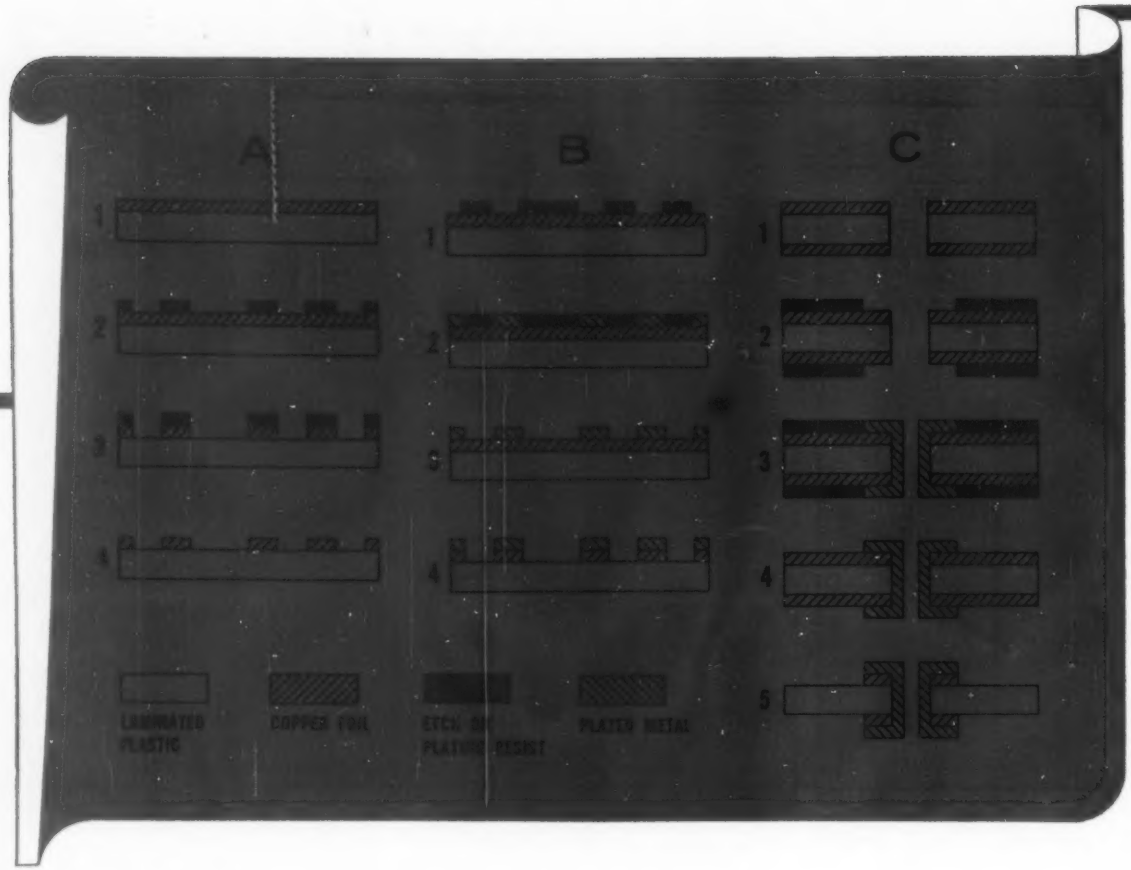
Fig. 6—Frequency meter before (left) and after (right) application of printed circuitry

Fig. 7—Radiosonde with printed (left) and conventional circuitry (right)

Photos courtesy Signal Corps Engineering Laboratories







How Etched Circuits are Made

by Robert L. Swiggett*

THE principles used in the manufacture of etched wiring are shown diagrammatically above. The steps under "A" are those used in producing the simplest form of etched wiring. "A_1" is a thin layer of metal foil laminated to the insulating plastic. "A_2" is a foil-clad laminate printed with an etch resist in the form of the desired pattern. "A_3" is the combination after the unwanted foil has been etched away. "A_4" is the etched circuit pattern left on the insulating support.

Often the original foil must be plated with some other metal. For example, if the circuit pattern is to be used as a switch, slip ring, or commutator, it may be necessary that it be plated with nickel or nickel and rhodium. In another case where it may be desirable to solder lugs or other hardware to the pattern, it may be advisable to have the pattern solder plated. Steps under "B" demonstrate the procedure usually used to produce a plated pattern. "B_1" is the copper-clad plastic printed with a plating resist in the reverse of the desired pattern. In "B_2," the plating has been applied to the areas left exposed by the plating resist. In "B_3," the plating resist has been removed. "B_4" is the desired plated pattern achieved by etching away the unwanted copper foil with an etchant which does not attack the metal plating but does attack the copper; this is used when isolated segments of the conductor pattern make it impossible to plate the copper circuit after etching.

Under "C" is shown the method used for plating through holes. The purpose of plating through a hole is to provide a through connection from the conductor pattern on one side of the insulator to the pattern on the other side and also to improve dip soldering. Making through connections this way is obviously less expensive than the use of eyelets. In addition, through-plating is more reliable than eyelets. Dip soldered joints are better when used with plated-through holes because the solder will flow up around the component wires in the holes and form fillets on both the top and bottom of the board. Soldered joints made this way have tremendous shock and vibration resistance.

In "C_1" is shown a sheet of plastic laminate clad on both sides with copper foil and with a hole punched or drilled through. "C_2" shows the same material printed on both sides with a plating resist in the reverse of the desired pat-

* Executive vice president, Photocircuits Corp., Glen Cove, New York. Mr. Swiggett also cooperated in the preparation of much of the accompanying article.

tern. The inside of the hole has also been made conductive with a thin metallic film. "C_3" shows the hole and the desired conductor pattern plated. "C_4" shows the plating resist removed and "C_5" shows the unwanted foil etched away.

Methods "A," "B," and "C" all assume metal foil clad plastic laminates as a starting point. These laminates are manufactured by laminating sheets of electrolytic copper to the sheets of plastic with a thermosetting adhesive film under heat and pressure. It is possible, however, using the principles shown in "B" and "C" to produce a completely plated circuit from a sheet of plastic which has not been initially copper clad.

When working with un-clad plastic surfaces, a very thin conductive metal film is deposited on the plastic sheet by one of the well known processes such as vacuum deposition, silver reduction, etc. The next steps are the same as in "B" and "C_2," "C_3," "C_4," and "C_5." A reverse or negative print with a plating resist is made over the conductive film. The panel is then plated with copper and with silver or solder over the copper. After the plating resist is removed, the very thin silver film may be removed rapidly and inexpensively. The advantage, of course, is that the cost of laminating and of etching away the copper foil layer is done away with. The disadvantage is that it is more difficult to achieve a bond between the conductor pattern and the laminated plastic which is good enough to stand the thermal shock of dip soldering.

Some preparation for the surface of the laminated plastic is necessary before the conductive film is applied. This may take the form of mechanical or chemical roughening or use of a semi-cured or uncured adhesive on the surface. Motorola Corp. has publicized this printed circuit process as the Placir method.

10% below the required value so that they can be automatically adjusted to value by abrasion. This involves abrading by grinding, blasting with fine abrasives in an air stream, or any other method which can quickly and accurately reduce the area of the printed resistor. The resistance value is measured constantly as the abrading proceeds, the equipment being so designed that it will immediately stop the abrading operation when the required resistance has been reached.

Such resistors are now being used by Emerson experimentally on several of their portable radios including a pocket model which weighs less than one pound and is so small that it fits into a man's breast pocket. The small size and light weight of this model is in large part credited to the use of printed panel board and printed resistors.

Signal Corps

The Signal Corps has developed many electronic items using printed circuitry. Only a few can be discussed in print because of the confidential nature of their end use. One item (Figs. 4 and 5) is a crystal controlled radio receiver working at video frequencies. When the first models were made using conventional wiring techniques, the bulkiness of the product as well as the difficulties encountered in assembling the components and hand soldering the connections made it an "impossible" job until the printed circuit technique was used. Four subminiature tubes and 31 components have now been designed into a package measuring 1½ in. in diameter by 3½ in. long. As seen in the exploded view (Fig. 5), several disks of printed circuits are used, with tubes and associated components assembled and dip soldered to their respective disks.

Another Signal Corps development employing printed circuitry is found in a meter used for measuring communication frequencies, shown "before-and-after" in Fig. 6. The "after" unit is about 1/10 the volume and 1/10 the weight of the "before" meter. Approximately 2/3 of the reduction in size can be credited to the use of printed circuitry; the remainder was accomplished by the incorporation of transistors.

A further Signal Corps application is a radiosonde which, carried aloft by free balloon, continually sends back to a ground station radio signals giving information such as barometric pressure, temperature, etc. Figure 7 shows the great reduction in size of the radiosonde gained by using printed circuits. The transmitter at the right was assembled by conventional means while the transmitter at the left made use of printed circuits.

The three Signal Corps products just described use phenolic bonded paper laminate as the base for their printed circuits.

TV, Radio, Remote Control

RCA Victor is now in mass production of intermediate-frequency amplifiers which are essential parts of every home TV set. Not only is the wiring etched on foil clad paper-base phenolic laminates, but the transformer components of the amplifier are also printed, thus eliminating laborious and expensive wiring and winding operations required for conventional components. Figure 8 shows the complex wire wound part compared with the printed component. Figure 9 shows the neat appearance of the complete printed circuit amplifier. The savings over hand wiring can easily be realized; each of the etched copper lines shown on the under side of this unit would have to be a separate wire with each terminal separately soldered if the hand wiring technique had been used. With the printed circuit method, one solder dip completes all soldering operations.

Photocircuits Corp. is producing another intermediate-frequency amplifier for television, shown in Figs. 10 and 11. The inductances as well as all the interconnecting wiring are printed and all of the connections are made by a one-shot dip solder operation. The material is 1/16-in. phenolic-paper laminate; the copper circuitry is 0.00135 in. thick.

Here again, the savings in cost over a conventionally wired unit are due largely to decreased assembly labor, easier inspection and trouble shooting, and production space saving. A further inducement to the manufacturer to use printed wiring in this type of sub-assembly is that this is the first step toward the completely automatic assembly line.

Motorola has been one of the leaders in the use of printed circuitry in home radios. Their method of apply-

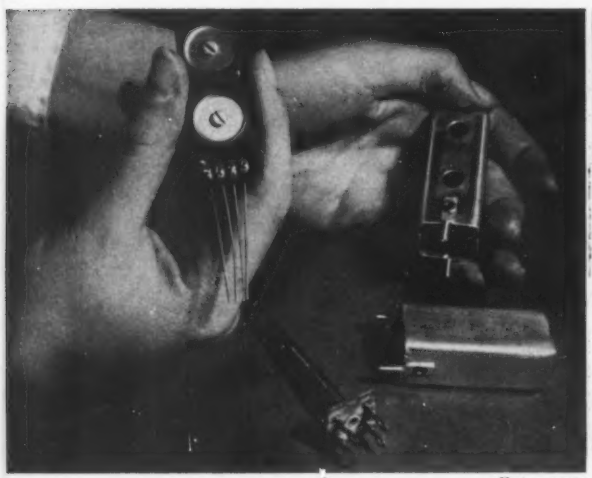
ing printed circuitry on the plastic laminate is discussed on p. 95. The latest use of this type of chassis has been in a clock radio. Figure 12 shows the small amount of chassis wiring and the minimum space required for printed circuitry. Motorola claims that these printed wiring components will not burn out, jar loose, short, or wear out.

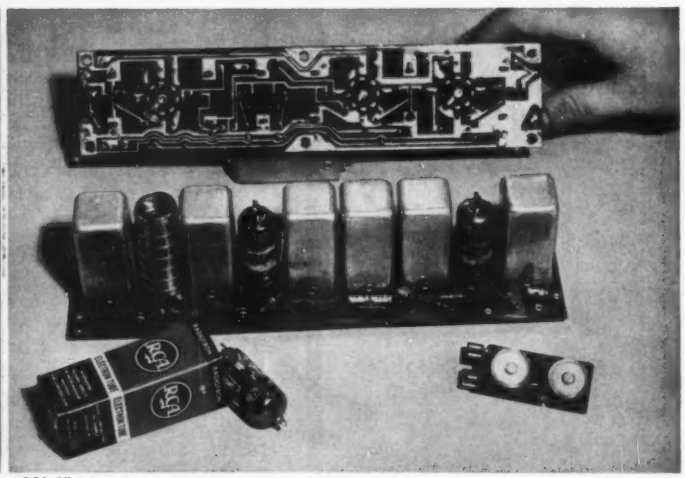
Admiral Corp. is also using prefabricated printed wiring in several models of their home receivers. Their future plans call for increased usage in their radio line, and their research program continues steadily to investigate adaption of printed circuitry to their TV sets. Figures 13 and 14 illustrate the neatness and small size attained by Admiral in one AC-DC radio chassis.

When asked about relative costs, Admiral stated that a comparative cost analysis cannot be made at present due to variances in price structure. However, the company claims that the products are greatly improved and that per-person assembly rates are much higher than ever attained previously. In fact, it is expected that in a short time the production rate per person will be almost double that possible with individual wires and soldered joints.

The North American Model Products, Inc., Newport News, Va., are manufacturers of radio transmitters and receiver kits specifically designed for remote control of planes, cars, boats, and other moving models. Both the transmitter and receiver make use of printed circuitry on a phenolic paper base laminate. In the receiver (Fig. 15), the printed circuitry consists of a wiring board; in the transmitter (Fig. 16), the circuitry includes not only the wiring but also the final tank coil (Fig. 17). North American makes use of the silk screen method of applying the circuits to the plastics panels. This company states that it intends to use printed circuits in all its future electronic products because it re-

TV Amplifiers

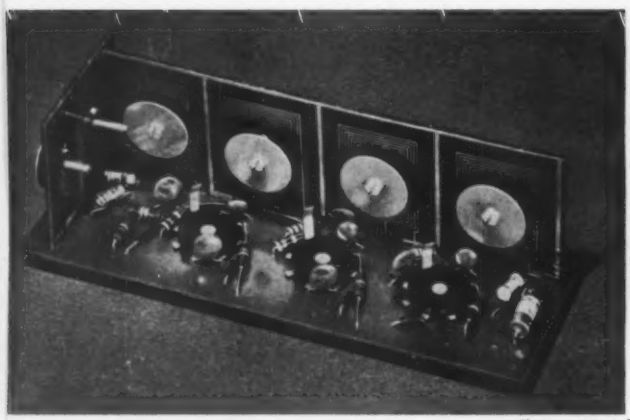




Photos courtesy RCA Victor

Fig. 8—Printed i.-f. transformer (upper left) replaces complex wire wound part (foreground)

Fig. 9—Neatness is improved and production costs are lowered for this i.-f. amplifier through the use of printed circuits and dip soldering techniques

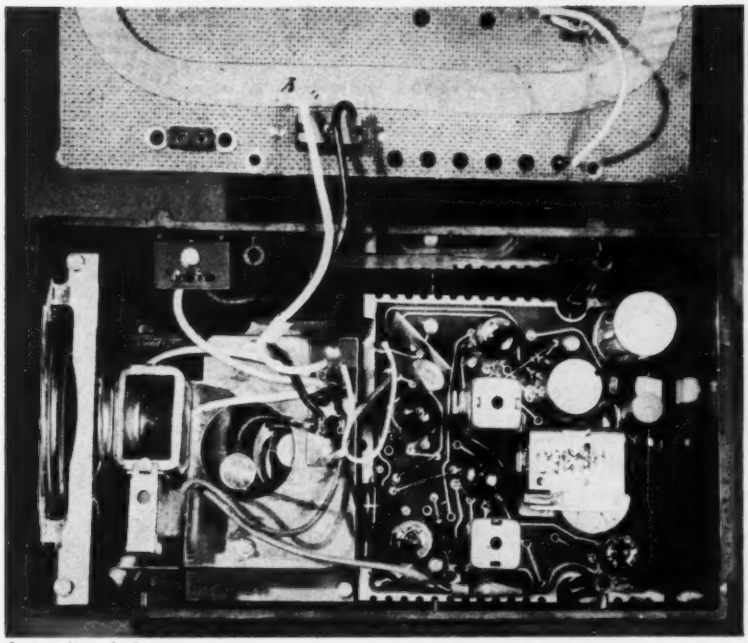


Photos courtesy Photocircuits Corp.

Fig. 10—Another television i.-f. amplifier has printed inductances as well as printed interconnecting wiring

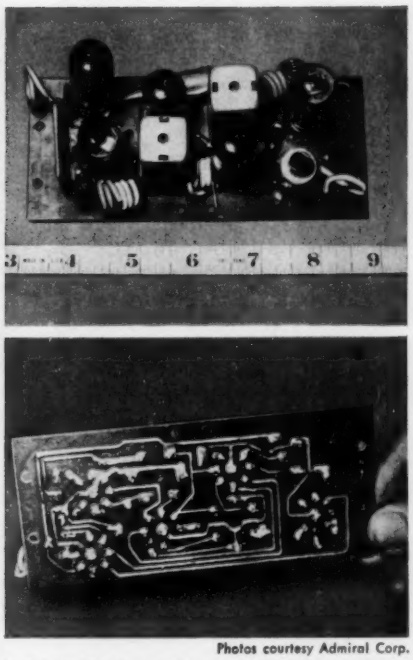
Fig. 11—Underside of amplifier shown at left. Base is 1/16-in. phenolic laminate, connections are made by a one-shot dip soldering operation

Radio Receivers



Courtesy Motorola Inc.

Fig. 12—Small amount of chassis wiring and minimum space requirements are some of the factors which have led to the application of printed circuitry to home radio receivers, as exemplified in this top chassis view of a recently introduced clock radio



Photos courtesy Admiral Corp.

Fig. 13 (top)—Neat and compact AC-DC radio chassis illustrates advantages of use of printed circuits
Fig. 14 (bottom)—Underside of chassis shown above

gards this as the only way to produce quality products and still stay in the price range of the average hobbyist.

General Electric Co. has greatly simplified its photoelectric control for outdoor lighting and at the same time has reduced maintenance costs. This is a device which turns on outdoor lights when the illumination from the sky is below a certain level and turns them off again when this level increases to a predetermined point.

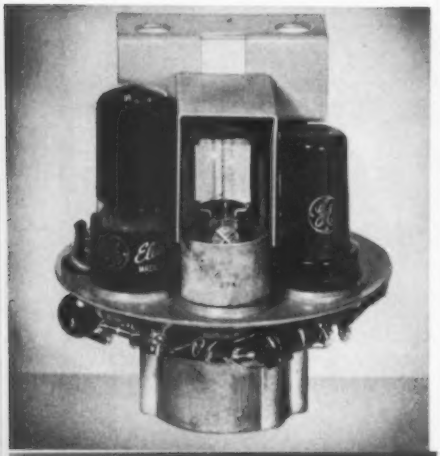
Figures 18 and 19 graphically show the difference between the old style wired control and the new unit which makes use of a printed circuit and dip soldering.

Microstrip Wiring

Federal Telecommunications Laboratory, Nutley, N. J., is now using what is termed microstrip wiring to replace microwave plumbing in much of their wave guide or coaxial circuitry. This patented development makes use of a Teflon fibrous glass laminate with copper foil bonded to both sides The printed circuitry on one side of the laminate is

Remote Control

Light Control



produced by the photo-etch system, but during the etching process the copper foil on the other side is completely protected by the acid resist. Thus, the final product consists of the plastic laminate completely covered with copper foil on one side and with a circuit pattern on the other. By this method the bulky and dimensionally critical wave guide and coaxial elements formerly required for all microwave transmission and reception have been replaced by simple, compact, and inexpensive circuitry elements based on copper-clad Teflon laminates. Figure 20 shows a microwave receiver constructed of microwave plumbing; the unit weighs 32 pounds. Figure 21 shows its equivalent constructed with microstrip. Here the receiver weight is reduced to 5 lb. and the over-all size reduced to about ¼ of the original.

Photocircuits Corp., a pioneer in printed circuitry, reports many applications in highly competitive fields. For example, in the switch in Fig. 22, each of the wafers in the stack is made of 1/16-in. phenolic laminate with 0.0027-in. copper circuitry plated with 0.002-in. of silver. Previous to using a printed circuit design, one of the major costs in the assembly of this switch was wiring the jumpers connecting the various contacts. In the printed circuit version, the contacts and jumpers are all printed at once, resulting in a cost reduction of about 40 percent.

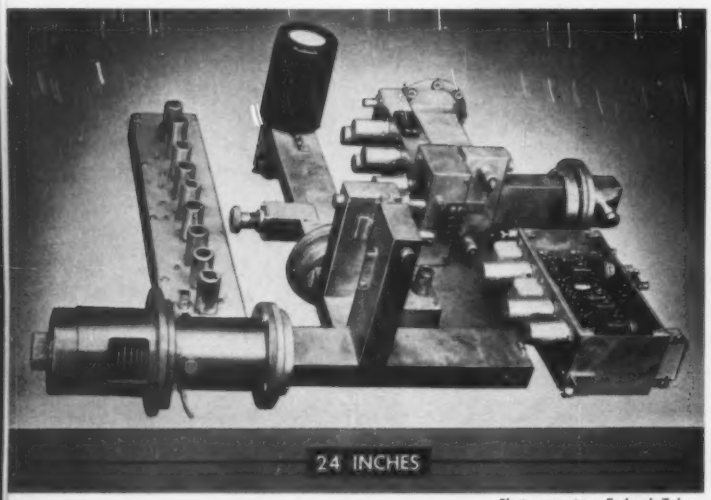
Figures 23 and 24 show a computer circuit about 6 by 10 in. in size. The base material is ⅛-in. thick epoxy glass laminate, use of which was dictated by good mechanical strength and low moisture absorption. Even though this assembly is fairly large in size, dip soldering is carried out easily and successfully. The use of plated-through holes and conductors on both sides of the laminate makes a very neat assembly of what would be a difficult and time-consuming wiring job by conventional methods.

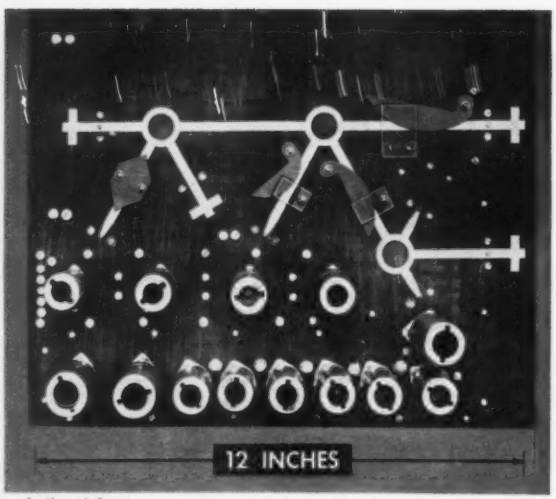
Wiring Boards

Printed wiring boards up to 36 in. long have been made for computer panel wiring. Hand wiring of complex computer as accounting machine panels is a very tedious process. Even though the number of panels may be small, printing the wiring saves money and definitely produces a neater assembly.

Although the cost savings are highly variable according to the complexity of the wiring board, a positive savings figure can be deduced from the fact that nearly every printed circuit prototype board can be produced at the same or slightly less cost than the hand wired type, even including the cost of the tooling, and that the prototype tooling can be used for production runs.

Microwave Assembly





Photos courtesy Federal Telecommunications Laboratory

Fig. 20—Microwave receiver constructed with conventionally used microwave plumbing; weight of this unit is 32 pounds

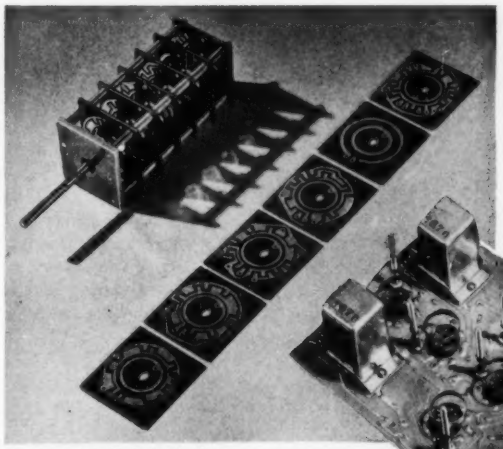
Fig. 21—Equivalent microwave receiver, built with microstrip printed circuitry: weight 5 lb., size 1/10 of original

Switches and Computers

The various stages in the assembly of a channel separator element designed by Photocircuits Corp. for La Pointe Electronics Inc., are shown in Fig. 25. The problem was to provide a parallel resonant circuit connecting two TV antenna dipoles. The circuit had to be a mechanical support for the two dipoles as well as an electrical separator at 195 megacycles. The solution was to make a coil and capacitor circuit on 1/32-in. XP laminate with two large plated-through holes. Two aluminum eyelets, sized to slide over the aluminum antenna dipole tubing, are pressed into the plated holes. This assembly is then potted in an epoxy resin to provide strength and moisture resistance. Special machinery was developed for mixing and dispensing the short pot-life resin-catalyst combination.

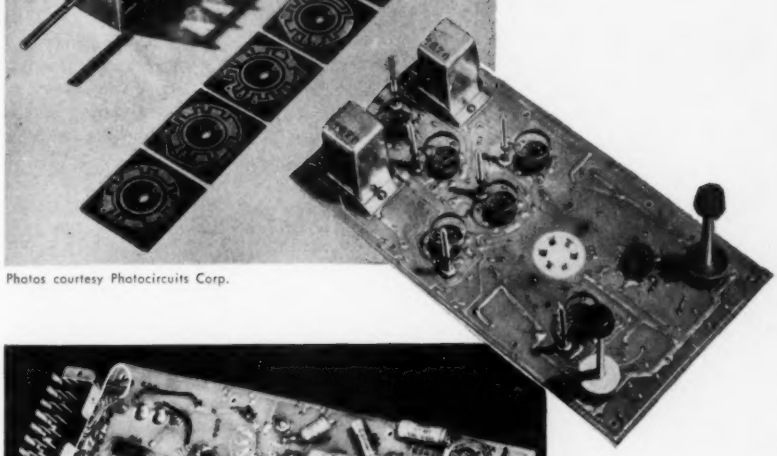
Printed circuitry makes possible production of complex rotary and sliding switch configurations at a cost lower than by any other manufacturing method. In addition, some parts could scarcely be made any other way. The code disk in Fig. 26 is an example. When a pattern is printed, complexity adds little if anything to cost, but if the metal patterns shown had to be machined or stamped, tooling or fabricating costs would be high. When made by etching or plating, the only set-up

(*Continued on p. 217*)



Photos courtesy Photocircuits Corp.

Fig. 22—Each wafer in this switch is made of 1/16-in. phenolic laminate printed with silver-plated copper circuitry



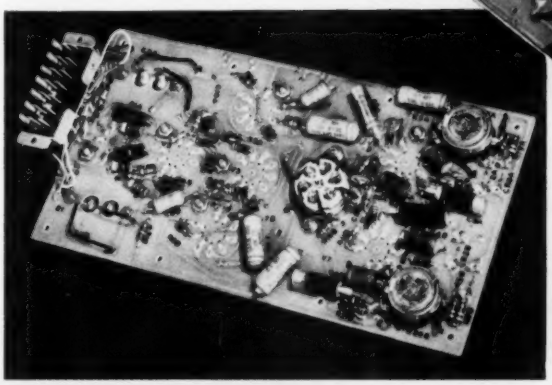
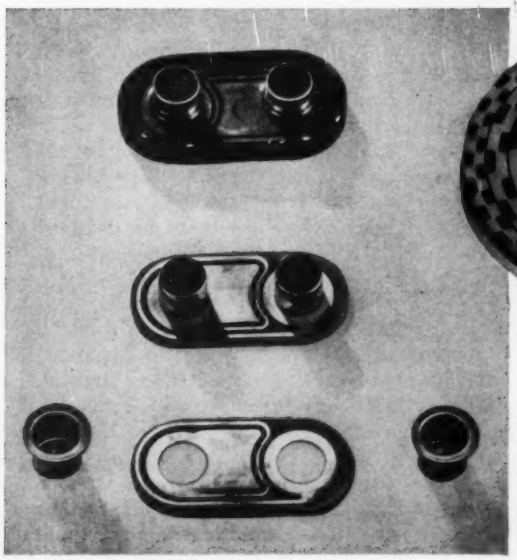


Fig. 23 (above)—Top view of computer circuit using 1/8-in. epoxy-glass laminate for base
Fig. 24 (left)—Bottom view of circuit; plated-through holes permit conductors on both sides

Code Disks and TV



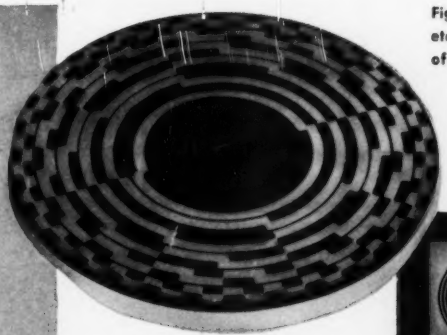


Fig. 26—Circuit plating and etching techniques lessen cost of complex code disk

Fig. 27—Wiring, coils, and capacitors in this television interference filter are all printed

Photos courtesy Photocircuits Corp.

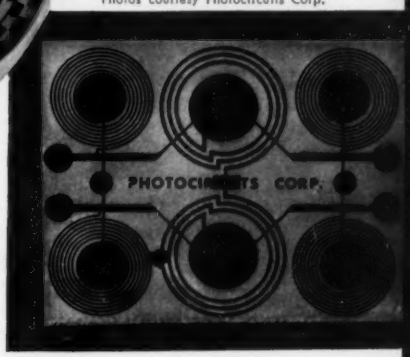


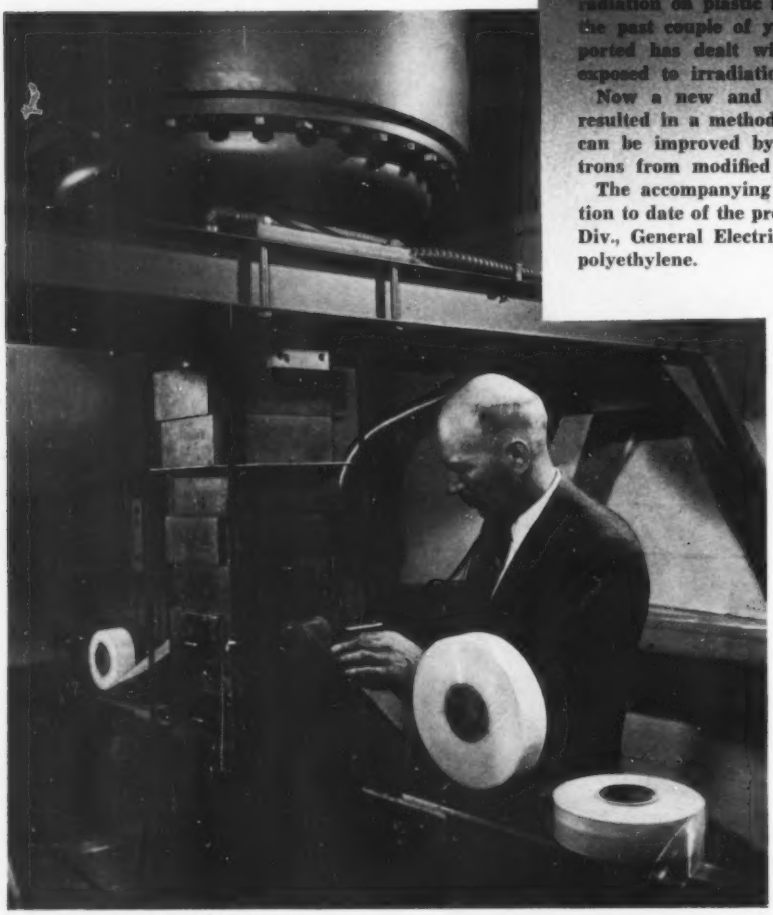
Fig. 25—Stages in construction of channel separator with printed coil and capacitor circuits

IRRADIATED POLYETHYLENE

Numerous technical articles about the effects of nuclear radiation on plastic materials have been published during the past couple of years. Generally the research thus reported has dealt with the breakdown in plastics when exposed to irradiation.

Now a new and revolutionary piece of research has resulted in a method whereby one plastic—polyethylene—can be improved by bombarding with high energy electrons from modified X-ray equipment.

The accompanying article is the most complete description to date of the process being developed by the Chemical Div., General Electric Co., to treat molded and extruded polyethylene.



Illustrations courtesy General Electric Co.

Polyethylene film is treated by irradiation in experimental high-energy electron generator; such treatment imparts several thermosetting qualities to the material

TAKE a piece of polyethylene film which begins to soften around 165° F. and melts around 230° F., bombard it with invisible high-energy electrons and convert it from a thermoplastic to an infusible polymer without loss of other desirable properties.

Basically, that is the new process resulting from work done by the Research Laboratory of General Electric Co. and now under intensive development by the Chemical Div. of that company.

The process presages a revolution in polyethylene applications in the electrical and packaging fields and in fields involving a wide variety of other products.

Exploratory work in the high energy electron field was conducted in General Electric's Research Laboratory as early as 1925 by Dr. D. W. Coolidge, inventor of the modern X-ray tube. Early availability of high-capacity resonant transformer type electron generators should make irradiated polyethylene a practical proposition in the not too distant future.

Continuous Process

The process consists of electron bombardment by a modified G-E resonant transformer or X-ray machine, the modification consisting of removal of the target and replacement of it with a thin metallic window, thus enabling the electrons to escape into the air and impinge upon the material which is being treated by irradiation.

The process, when refined, will of necessity be continuous and high-speed. Because X-rays are produced whenever these high-energy electrons strike solid matter, commercial equipment will have to be heavily shielded, and certain safety precautions must be taken to protect operating personnel.

For most high-volume work, units capable of accelerating the electrons from one to several million volts appear likely to be required.

By the irradiation process, polyethylene is changed in molecular form so that it will no longer melt at any temperature up to the point where it chars. However, still being an organic polymer, irradiated polyethylene will not withstand indefinite exposure at high temperatures. In those applications where irradiated polyethylene is continuously exposed to high temperatures under oxidizing conditions, as in a hot air blast, it has been necessary to formulate new specially stabilized polyethylene compositions designed purposely to inhibit degradation.

Thermoset Polyethylene

The process also eliminates the troublesome tendency of fabricated and molded pieces, when stressed, to crack in certain environments. Tests conducted to date show no evidence of cracking in irradiated polyethylene parts when stressed and in contact with many active chemicals—conditions which would

cause complete failure of unirradiated polyethylene. Otherwise, the new thermoset polyethylene retains all the excellent properties of the thermoplastic or non-irradiated form, being flexible, translucent, and extremely acid resistant, and having, in addition, good electrical properties.

Since irradiated polyethylene has no melting point, it is not possible to irradiate and subsequently injection or compression mold satisfactory pieces.

There is some possibility that cross linking which occurs during the process may improve resistance to permeability, although tests to date indicate that this may not be significant except for borderline cases.

There are also indications that low-temperature toughness of polyethylene is improved. It has been shown that the irradiated polyethylene will not distort at temperatures far above the normal melting point of the non-irradiated material when not under stress. The irradiated form has a tensile strength of only 100 to 200 p.s.i. above 230° F. While low, this is felt to be sufficient for many uses. There is essentially no change in moisture vapor transmission rates. Gas transmission rates for irradiated polyethylene have not been evaluated.

Aging Properties

Certain stabilized polyethylene films will withstand prolonged aging at 300° F. and short time exposure to 450° F. They can be heat-sealed but not welded.

While no work has yet been done on colored material, dyes can be selected which will not be affected by the radiation. Transparency or translucency remains unchanged. Due to its cross-linked structure, irradiated polyethylene will swell but not dissolve in primary solvents for polyethylene.

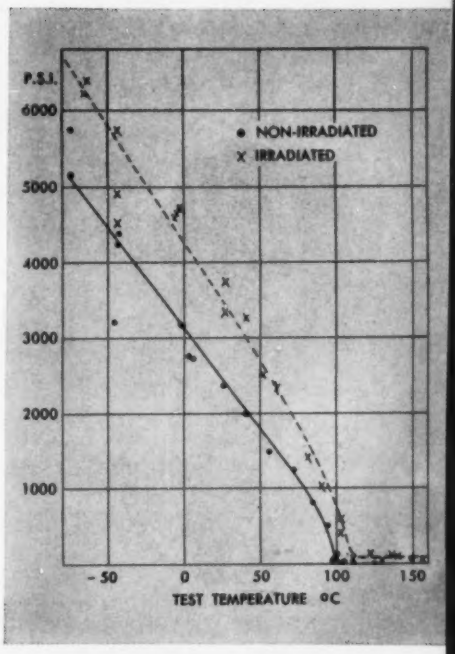
Certainly by eliminating the low melting point of polyethylene through irradiation, expanded uses for this new plastic material will be found in the packaging and electrical fields.

Electrical Insulation

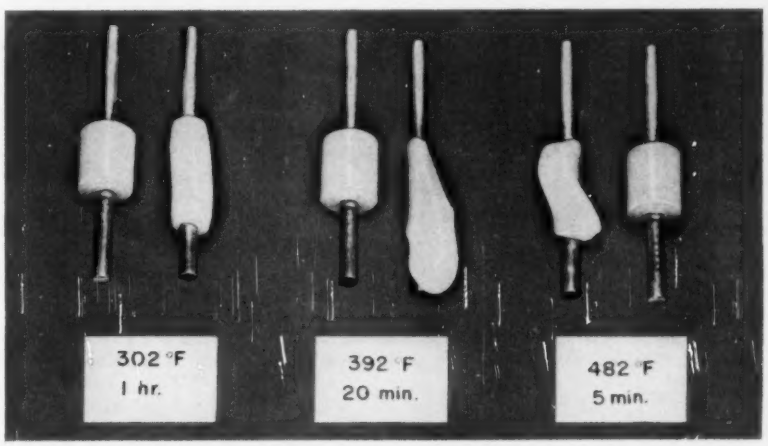
The outstanding electrical properties and moisture resistance of polyethylene have long qualified it as an outstanding insulation material, but its previous low softening point has prevented its application at operating temperatures about the 165 to 185° F. range. With polyethylene stabilized against oxidation and irradiated—thus made thermoset—it should find many applications in the form of tape or film in electrical equipment. This in turn can make possible size reduction in electrical equipment with improved operating characteristics.

Studies of the economics of elec-

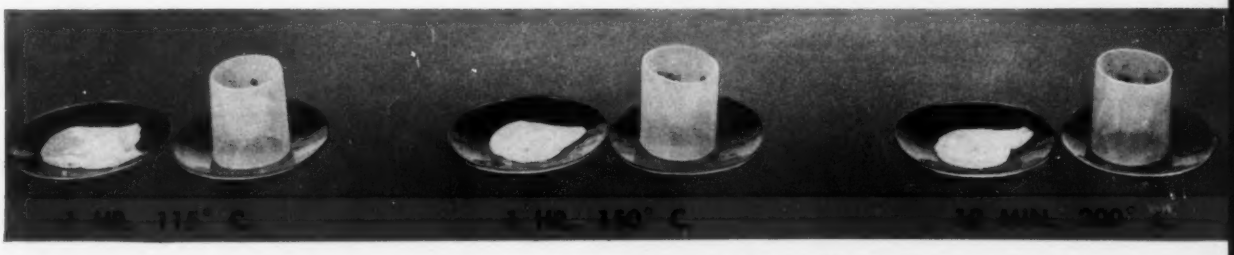
(*Continued on p. 219*)



Tensile strength vs temperature for irradiated and non-irradiated film

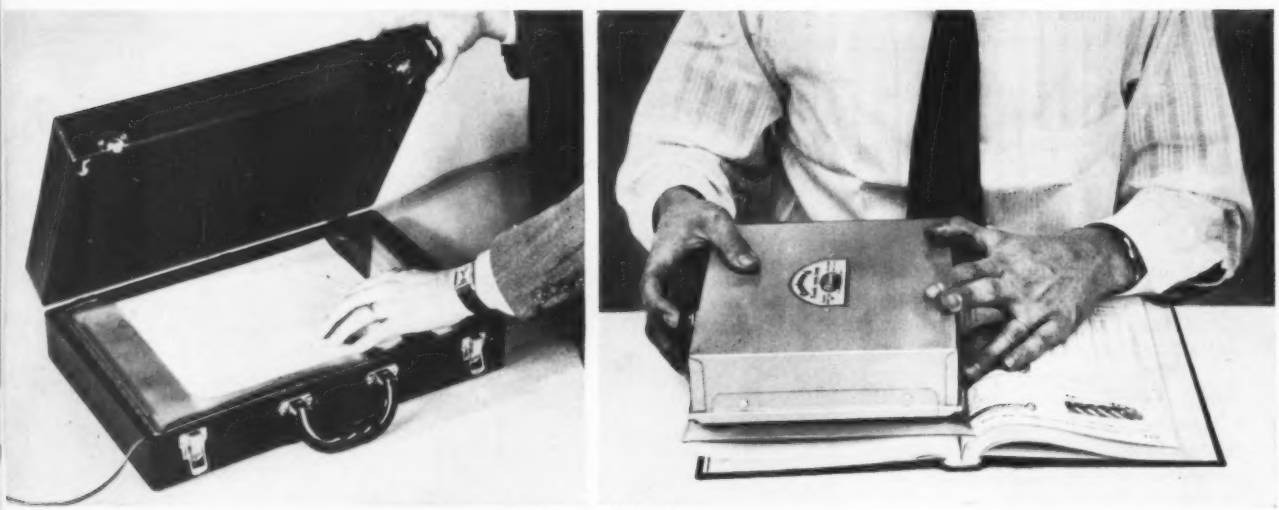


Heat resistance of relatively thick samples of polyethylene is improved by irradiation. Treated samples retain their shapes, while untreated specimens readily distort



Heat resistance of thin sections of polyethylene are also improved by irradiation. In above photo, untreated samples are at left in each case, irradiated specimens are at right. Market possibilities of thermoset stabilized polyethylene are under active consideration

Eight plastics used in two photo copier units contribute to ease of operation, light weight, and resistance to corrosive processing chemicals



Courtesy F. G. Ludwig, Inc.

Negative paper, in contact with document to be reproduced, is placed on inflatable vinyl cushion (left) which serves as top surface of Constat photo copier, and is exposed to light. To conveniently copy pages in bound book (right), entire unit, removed from case, is inserted

PHOTO copying machines that can reproduce within a matter of minues anything written, printed, typed, or hand-drawn have already proved themselves an important asset to the modern business office. They are equally important as a market for plastics.

In operating parts, accessories, and housings, plastics have been largely responsible for today's photo copiers being lighter in weight, easier to operate, and more functional in design. As a result, the volume of plastics going into both new models and improvements on existing models continues to expand.

In two recent additions to the photo copier market, eight different plastics are used to advantage.

Variety of Plastics

The Constat copying and developing system, produced by F. G. Ludwig, Inc., Deep River, Conn., uses flexible vinyl, rigid vinyl, polyethylene, phenolic laminate, and reinforced plastics parts. The Anken processor, a product of Anken Film Co., Inc., Newton, N. J., has a housing formed from copolymer sheet and uses molded nylon gears and cast phenolic rollers.

While both copying processes accomplish the same end result—speedy and accurate reproduction of letters or documents—the methods and equipment used are quite different.

The Constat system of copying is based on the transfer process in which both positive and negative papers are used. Two separate operations are therefore necessary. First, the negative paper must be exposed to the matter to be copied over a light box or contact printer and, second, a positive print must be made from the exposed negative by contact between the two sheets of paper.

In the Constat system, a separate unit is used for each operation. The Contoura photo copier is basically a metal box which contains a bank of light bulbs and a series of diffusers; the Constat dry-processor is a reinforced plastics box in which the photographic papers are developed.

The two units can be used either together as a single system or separately with any other type of photo copier or developing unit.

Vinyl Cushion

The plastic component in the Contoura photo copier is an inflatable vinyl cushion that enables the unit to reproduce pages from bound books or magazines without damaging the binding.

To reproduce such material, the entire photo copier is first removed from its plywood carrying case and the cushion is inflated either orally or with a small hand pump. After placing a special negative paper over the page to be copied, the unit, with the vinyl cushion faced downward, is placed on top of the negative paper. The light is then switched on for about 10 sec., after which the negative paper is ready for processing. The unit operates on any 110-v. AC-DC outlet.

Since the cushion is made up of two sheets of 20-gage flexible vinyl electronically sealed together, the face of the cushion, when inflated, conforms perfectly to the curved contours of bound books or magazines. The weight of the photo copier insures proper contact between vinyl cushion, negative paper, and the page.

A 60-gage press-polished rigid vinyl sheet is bonded to the cushion to act as backing and to help diffuse the light.

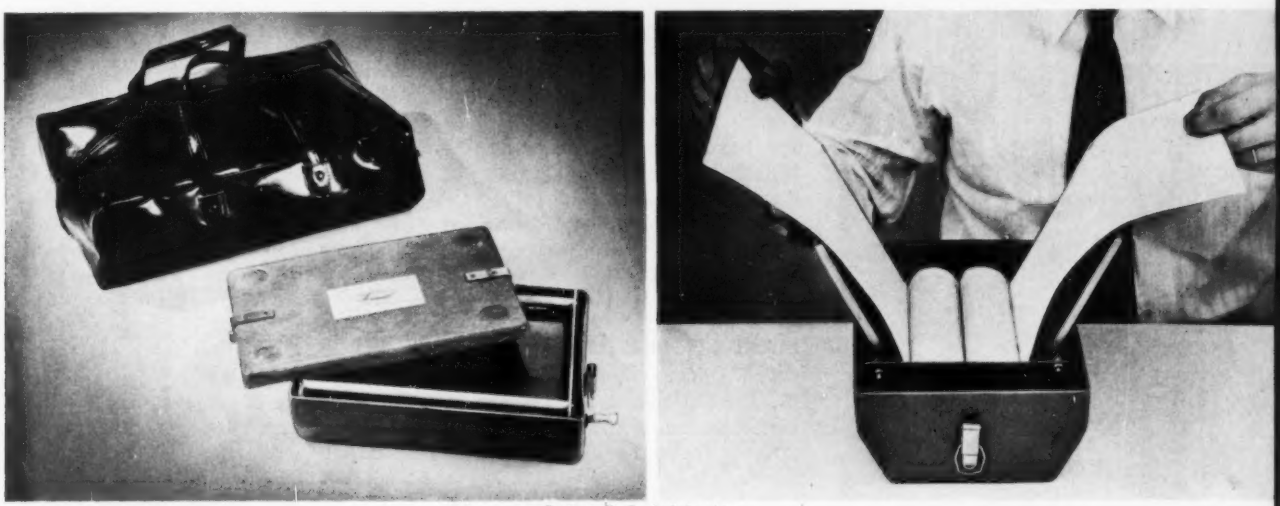
For reproducing material other than pages in bound books or magazines, the copier can be used while still in its carrying case. The negative paper, in contact with the matter to be reproduced, is simply placed on top of the vinyl cushion—which faces upwards when in the case—and the light is switched on.

The portable photo copier is available in two sizes—an 8½- by 10½- by 2¼-in. model which weighs 4 lb., and a 9½- by 14½- by 2¼-in. model which weighs only 7 pounds.

The second unit in the Constat system, the dry-processor, is housed in an attractive box molded of polyester resin-fibrous glass laminate; its two end plates are machined from laminated phenolic; and a squeezable polyethylene mixing and storage bottle is supplied with the equipment as a standard accessory.

Developing the Negative

When using the dry-processor, the exposed negative paper from the copier is fed into one side of the unit and the special positive paper is fed into the other side. A series of rollers, operated manually by a



Courtesy F. G. Ludwig, Inc.

Image on exposed negative paper is transferred to positive paper as the two sheets are passed by rollers (right) through a developing solution stored in the base of reinforced plastics processing unit (left). When not in use, unit is housed in vinyl carry-all (left, background)

Plastics parts in Constat system include (front to back): phenolic laminate end plates; vinyl cushion; and polyethylene mixing-storage bottle for the developing solution

handle at one end of the reinforced plastics box, picks up the two sheets and passes them through a developing solution in the tray-like base of the box. The two sheets, adhered together, emerge from between the center rollers where they have been squeezed face-to-face. By the time the two papers are peeled apart, the positive sheet has become a black-on-white print.

The reinforced plastics housing of the processor unit is dark grey in color, with the white fibrous glass pattern accentuated for modern styling. Both parts of the housing—the shallow cover as well as the deep bottom base—are produced in matched metal molds from polyester resin-impregnated fibrous glass preforms.

The compact and rugged housing is crack-proof, chip-proof, and light in weight. Completely assembled—with the cover attached to the base by two clamps—the entire unit stands only 4 in. high, 12 in. long, and 6 in. wide; including the rollers and operating parts, it weighs 8 pounds.

Inside the housing, two end plates machined from phenolic laminate serve as a support for the rollers. Holes drilled into the plates accommodate the roller shafts. Like the reinforced plastics housing, the rugged phenolic laminate parts are completely immune to the corrosive developing solutions with which they are continually in contact.

In addition to the squeezable polyethylene bottle, a two-hole rubber stopper for the bottle and a 3-ft. syphon tube are also supplied. After the dry-processor has been used, the developing solution can be returned to the bottle for storage by simply fitting the tube into one of the holes in the stopper and syphoning the solution out of the developing box. A few squeezes on the flexible bottle will start the flow of liquid along the tube.

A moistureproof case fabricated from 30-gage unsupported vinyl sheet is available as a carry-all for the developing unit and accessories.

Base and cover of Anken processor are formed from copolymer sheet. Exposed photographic paper emerges as finished print through a slot in the cover

Direct Reproduction

The Anken processor differs from the Constat unit just described in that it produces the finished print directly from the exposed photographic paper.

The processor is a single unit designed only for developing the final print. Special photographic paper must first be exposed to the matter to be copied on any type of contact printer or black-light box before it is fed into the processor. Depending upon the order in which the photographic paper and the original matter are placed in contact with each other over the light source, either a negative or a positive print can be made.

No matter which end result is desired, however, the exposed photographic paper is simply fed into a slot in one side of the processor and is automatically delivered as a finished print from a slot on the opposite side of the cover. Only a few seconds are required; a 110-v. AC motor actuates the mechanism.

As the photographic paper is fed into the slot, it is picked up by a cast phenolic roller and immersed in a tray containing a developing solution. The paper is then passed along by a series of additional rollers and immersed in a second tray which contains a liquid stabilizer. Prints are delivered almost dry and can be immediately stacked on top of each other without smearing.

Formed Copolymer Parts

The four major components of the Anken processor are formed from Boltaron copolymer sheet. These parts include the large dome-shaped cover of the developing unit, the shallow base on which the cover rests, and two deep trays for the developer and stabilizer.

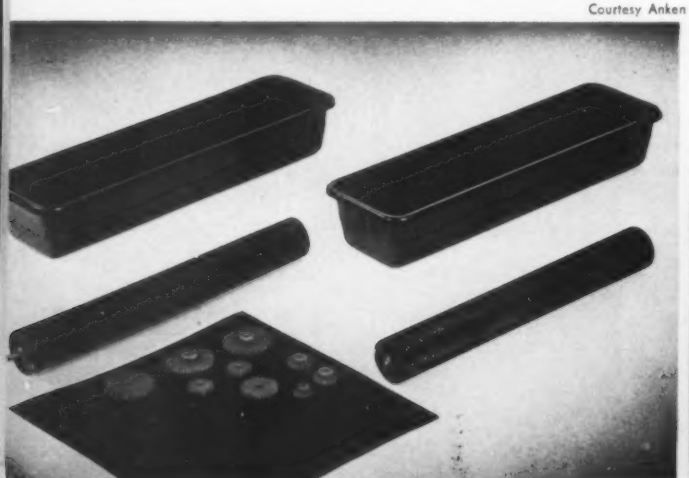
The choice of copolymer sheet as the major construction material was dictated by the need for a rugged material that would not dent or crack in use, would be light in weight, and would resist corrosion. Copolymer sheet not only met all three requirements, but, by making

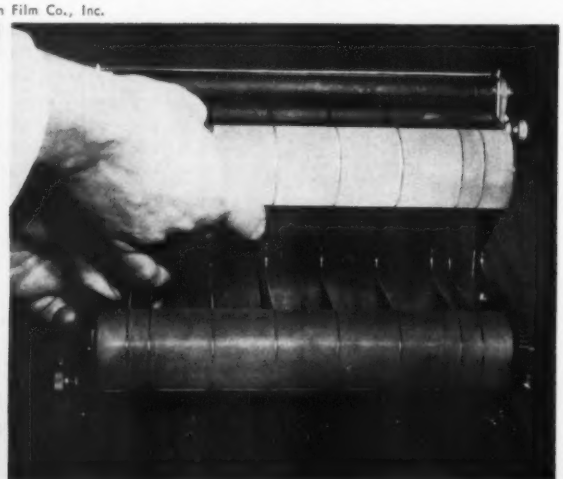
(*Continued on p. 221*)

Internal parts of processor include (front to back): nylon gears; phenolic rollers; and formed styrene copolymer developing trays

Grooves are machined in phenolic rollers to accommodate stripper blades that prevent wet paper from sticking to the rollers

Courtesy Anken Film Co., Inc.





Photos courtesy Resistoflex Corp.

Representative group of fluorocarbon-based products includes pipe, tubing, valve lining, and pipe accessories

Fluorocarbon-based pipe is prepared for flanged couplings by means of a simply operated, portable tool

SUPERPIPE

High heats, corrosive chemicals, extreme pressures are taken in stride by fluorocarbon-based pipe and hose

RECENT introduction of fluorocarbon hose and pipe provides practical solutions to many pressing industrial problems of handling corrosive fluids at high operating temperatures.

Engineers in the aircraft industry and in such processing industries as chemicals, foods, and pharmaceuticals, are constantly faced with such problems. Under the combined effects of high temperatures and the consequent exaggerated action of many of the corrosive chemicals commonly encountered in these industries, the life of conventional materials is considerably shortened, necessitating frequent and costly replacement of parts.

By taking advantage of the complete chemical inertness of the fluorocarbons and their excellent working performance over a wide temperature range, many of these problems can be successfully solved.

Fluorocarbon Hose

The new high temperature flexible hose, which consists of an extruded seamless Teflon tube reinforced with a braided jacket of stainless steel wire, was initially developed to meet the demands of the aviation industry for a hose to handle the corrosive synthetic oils and fuels used in jet engines. It's expected, however, that the new hose will also find application in various types of guided missiles which use extremely corrosive fuels and oxidizing agents, in hydraulic systems, and in many processing industries.

The hose is already in production on a pilot-plant basis to meet the immediate needs of the aviation industry. Before its introduction to the market, however, it was first subjected to exhaustive laboratory and field tests. These tests proved the hose completely able to withstand synthetic oils, fuels, alcohols, and virtually all chemicals and corrosives, and to retain its strength and flexibility at temperatures from −100 to 450° F.

Although light in weight for its size, the flexible hose is exceptionally strong. In burst pressure, vibration, fluid immersion, and circulation tests that were performed on the hose at temperatures up to 450° F., not one single assembly failed. Severe low-temperature tests and thermal shock tests were also successfully conducted. In one test, hose assemblies were soaked at −110° F. While still at this low temperature, high pressure oil at 450° F. was suddenly introduced into the line—without any adverse effects being observed.

The hose is currently available in a range of seven sizes, from ¼ to 1 in. in diameter. By the end of 1954, however, it is expected that diameters up to 1½ in. will be in production.

Various metal fittings are also supplied with the hose. The deformation characteristics of the fluorocarbon tube under pressure assures a leakproof, permanent seal.

Fluorocarbon Pipe

The laminated fluorocarbon pipe, companion product to the hose, consists of an internal extruded seamless Teflon tube covered with a reinforcing jacket of fibrous glass. For better performance under adverse conditions, the fibrous glass jacket itself is impregnated with additional fluorocarbon resins and cured under heat and pressure. Where nec-

(*Continued on p. 220*)

Vinyl

SPURRED on by the introduction of new and improved vinyl compound formulations, the outerwear garment field is developing into an important market for vinyl sheet material laminated to fabric backings.

Rivaling top-quality leather in appearance and performance, yet selling for about one-half as much, these new materials for outerwear —in the form of men's, women's, and children's jackets—have already created quite a stir in clothing circles. According to industry estimates, production of vinyl outerwear material had reached ¾ million yd. a month by the end of 1953; potential for 1954 is even larger. As one optimistic manufacturer put it, "by opening up a new mass market for attractively-priced

Courtesy The Masland Duraleather Co.

Attractive jacket fabricated of new vinyl outerwear material, is windproof and waterproof, as well as flexible even at low temperatures

In addition to jackets, the new material is adaptable to the manufacture of handbags and hats (bottom row)

Courtesy Monsanto Chemical Co.

Outerwear

New formulations produce vinyl sheet which, when laminated to cloth, yields materials rivaling top-quality leather in beauty and service—at half the cost

sportswear, the vinyl material should, within the next few years, take over 25 to 50% of the outerwear garment business."

Low Temperature Flexibility

Basically, the new vinyl outerwear material consists of a vinyl sheet, approximately 10 to 15 mils thick, backed up by a fabric of about the same thickness.

Because of the demands put upon sportswear outer garments, the vinyl face materials are specially formulated to resist exposure to the elements. They are windproof and waterproof; sun and salt water have no effect upon it.

Most important of all, the new formulations of vinyl will remain flexible even at low temperatures. No test data are as yet available on just how cold it has to be before the material stiffens. Each of the manufacturers interviewed, however, was willing to go on record that vinyl outerwear material will stand "freezing temperatures in the 0 to 32° F. range without cracking."

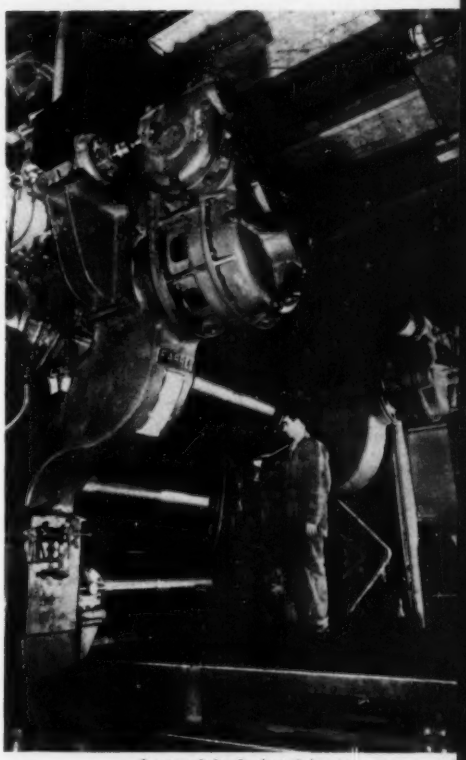
In addition to flexibility at low temperatures, the outerwear materials retain all the outstanding qualities of durability which characterize other vinyl fabrics. A jacket fabricated of vinyl outerwear material is tough and long wearing. It has a high degree of stitch tear resistance and, when properly tailored, there is little danger of button holes or seams pulling out or of any strain point giving way in use. Under normal wearing conditions, it will not scratch, scuff, chip, or peel. Finally, although lighted cigarettes or matches might scar vinyl outerwear material, the vinyl face of the fabric is so formulated that it will not support flame.

Cleaning of vinyl outerwear jackets is a simple job that requires only a damp cloth. If necessary, a mild soap can be used. While not completely stainproof, the vinyl outerwear will resist most common stains.

Appearance-wise, the many colors and embossed grains possible when manufacturing vinyl outerwear material are one of the biggest assets. The color range is virtually unlimited and grain-embossing presents little problem. Vinyl outerwear materials have already been successfully embossed with such grain patterns as kidskin, capeskin, doeskin, and horsehide. Even more important, the material can be embossed with attractive decorative effects that would be impossible to reproduce on animal hides. One company, for example, is experimenting with the possibility of adding a tweed design.

Color Control

The ability to control the color of vinyl outerwear has eliminated much of the waste found in working with natural hides. Since color can be kept uniform between rolls of the vinyl material, the outerwear garments can be produced in a full size range in any one color. Color shades of natural hide fabrics, in

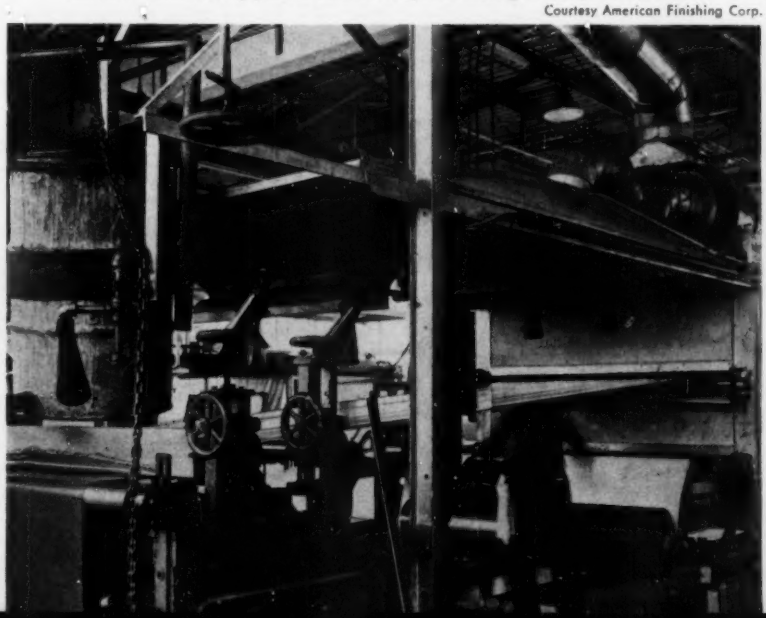


Courtesy Bolta Products Sales, Inc.

Vinyl face sheet can be adhered to fabric backing by calendering method

Another manufacturing process consists of spread coating the vinyl on the fabric

Courtesy American Finishing Corp.



contrast, differ—sometimes quite radically—between the many skins used for an outerwear article.

Wasted material—which often runs as high as 25% when cutting leather—can also be drastically reduced by controlling the texture and quality of vinyl outerwear material. In fabricating a jacket from a natural hide, a skilled operator must carefully work a usable pattern out of the hide by cutting around irregularities and blemishes. When working with vinyl outerwear material, in contrast, every inch of the material can be utilized. Up to 75 layers of the vinyl material can be stacked in one lay and cut with a medium speed knife.

Vinyl outerwear materials can be sewn on any standard commercial machine

Estimates of over-all savings in outerwear manufacturing costs effected by the use of the new vinyl materials range as high as 35 to 40 percent.

Method of Manufacture

In manufacturing vinyl outerwear material, the type of fabric used as backing, the method by which the vinyl is backed up, and the thickness of the vinyl sheet all play an important role in determining the physical characteristics of the end product.

Stretchability and durability, for example, can be controlled to a certain degree by the type of fabric that is chosen as the backing. The natural elasticity of the vinyl sheet permits the garment to always return to shape when pulling or seating pressure is released. For those manufacturers, however, who prefer less stretch, a sheeting, drill, or broken twill woven cotton fabric is used as backing; for more substantial stretch, a knitted cotton fabric is used. Other types of fabric, including knitted rayon, can also be used, depending upon the end result desired.

The manner in which the vinyl face sheet is adhered to the backing plays an equally important role in determining the durability, stretchability, and feel of the vinyl outerwear. Three methods are currently in use—calendering, spread coating, and casting. While these processes represent the basic methods of manufacture, there are, of course, many variations possible in each, depending upon end use.

Included among the companies which are already actively engaged in promoting vinyl outerwear material are: American Finishing Co., Memphis, Tenn.; Bolta Products Sales, Inc., Lawrence, Mass. (Boltaflex Outerwear); Federal Leather Co., Belleville, N. J. (Federlon); Firestone Plastics Co., Pottstown, Pa. (Velon Outerwear); Jason Corp., Hoboken, N. J. (Sofgrane, a calendered material using an Ultron vinyl formulation supplied by Monsanto Chemical Co.); The Masland Duraleather Co., Philadelphia, Pa. (Kidette); The Pantasote Co., New York, N. Y. (Panhyde); Textileather Corp., Toledo, Ohio (Tolex); and United States Rubber Co., New York, N. Y. (U. S. Elastic Naugahyde).

The Future

Currently, these manufacturers are enjoying a "hot" market. Since today's fashion trend in women's wear emphasizes the "leather look," vinyl outerwear garments have found a ready market. But whether or not the "leather look" remains as a women's fashion trend, vinyl outerwear has by now definitely secured for itself a firm foothold in the garment industry. This is particularly true in the men's and boy's apparel field, where the price and physical properties of vinyl outerwear materials have proved especially appealing to large segments of the buying public.

New fields are also opening for the material in the fabrication of accessories and of sportswear apparel other than jackets. These items include belts, handbags, leggings,

(*Continued on p. 223*)

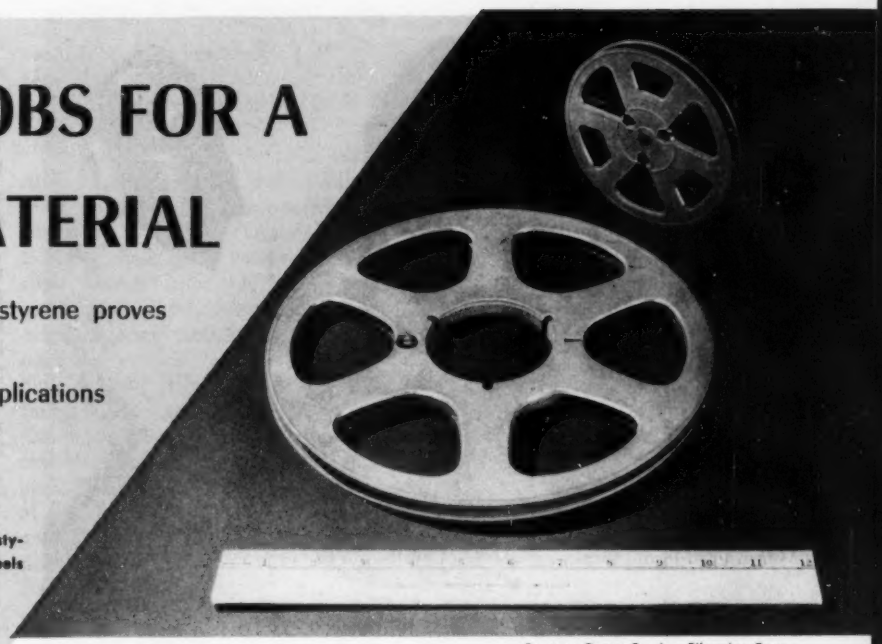
Uniform quality of material permits mass production and lowers costs

Photos courtesy Bolta Products Sales Co., Inc.

Vinyl jackets can be made in many colors and in many grain patterns

JOBS FOR A NEW MATERIAL

Glass-filled or reinforced styrene proves itself in a range of applications



Replacing aluminum, fibrous glass-filled styrene brings many advantages to tape reels

Courtesy Owens-Corning Fiberglas Corp.

SINCE reinforced thermoset plastics first became known, nearly everyone interested in styrene has thought of reinforcing styrene injection molding material to give it greater strength. Literally scores of attempts have been made, but until now results have been doubtful.

Now a new material, pioneered by Fiberfil Corp., Warsaw, Ind., and supplied by Koppers Co., Pittsburgh, Pa., and Fiberfil, has received enough field testing and has been successfully run in enough jobs to receive considerable attention from molders and end users.

Rod-Shaped Pellets

Called "Fibertuff" polystyrene by Koppers and "Fiberfil Styrene-G" by Fiberfil Corp., these molding compounds are supplied as rod-shaped pellets approximately ½ in. long by ⅛ in. in diameter—a size easily handled in conventional injection molding presses. The glass fibers are continuous parallel strands ½ in. long. There are approximately 12,000 glass filaments in each pellet. These filaments occur in bundles of 204, and each pellet contains 60 such bundles. These glass filaments are coated with heat-resistant polystyrene. The coating serves not only as the molding resin, but also acts as a lubricant to prevent abrasion between the individual glass fibers and erosion of the injection machine cylinder, or die.

Koppers has two types, Grade 1 and Grade X. Each contains about 65% of polystyrene. One type is externally lubricated so as to lower the bulk factor, improve the flow, improve mold release, and reduce dusting of the pellets. For those unusual applications where an external lubricant is objectionable the other and unlubricated type may be used.

These present styrene-fibrous glass materials are *not* intended for very high impact injection molded applications. The heavy load of polystyrene they carry would forbid their use for those applications where fibrous glass loaded with the tougher resins is commonly used. Furthermore, the material must be squirted through a nozzle and that process together with the action of other injection molding equipment tends to break up the length of the glass fibers.

The material does have one particularly important property that makes it highly desirable for military applications and some specialized civilian applications. That property is the ability to maintain its impact strength over a wide range of temperatures. It is about as strong at sub-zero temperatures as at normal room temperatures, while any of the modified styrene compounds or alloys have a tendency to become more brittle at low temperatures.

At the other extreme, this material's resistance to heat tests from 218° F. to 220° F. by ASTM D 648-45 T, compared with unmodified polystyrene of about 200° F. by the same test.

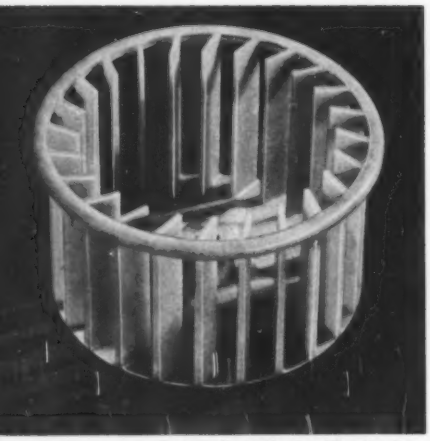
Rigidity

Another good property is the material's rigidity and lack of elongation. The rubber used in styrene alloy compounds gives high "impact" but may cause stretch under a heavy load. There is no such tendency with the fibrous glass-reinforced polystyrene. It will break before it will stretch or "give."

It also has a unique property that might be described as "resistance to yield under compression." Thus, when it is the core around which wire or tape is wrapped on a reel it does not "give" under the pressure of the wound-up wire or tape. This property is particularly important in sound tape reels that go off tone if the core "yields" the tiniest fraction. There may be some connection between this property and the fact that this compound shrinks less in the mold than most conventional molding compounds. Shrink is 1 mil per in.; styrene shrink is 4 mils per inch.

Another useful property is its

All major parts of new illuminated film viewer are molded of glass reinforced styrene to take advantage of high impact strength and dimensional stability of the material



Courtesy Owens-Corning Fiberglas Corp.

Glass-styrene fan for automobile heater does not deform under heat and load

very low water absorption. Specifications now permit 0.40% but there is every indication that even that low absorption may be reduced to 0.10% after compounding methods have been perfected.

Molds for handling this polystyrene fibrous-glass material ideally should be chrome plated. Otherwise there might be a slight erosion of the mold surface. The compound is rather hygroscopic and should be thoroughly dried before molding.

A greater danger is molding at too high a temperature. If temperature of the compound were permitted to rise above 700° F., the styrene could decompose and harm the mold.

Although considerable development in military applications of the new material has been going on for some time, no reportable military jobs have come up to date. It appears likely that it would work in battery cases and cells for arctic use where its cold-temperature resistance and good mold flow would help. It is also being studied for military electronic use.

Civilian Applications

Several high-volume civilian applications are currently in process. One is the large magnetic recording tape reels made by American Molded Products Corp., Chicago, for a number of accounts. Here the material replaces aluminum, being 50% lighter in weight than the metal and possessing in molded form less inertia. In the past, reel users have wanted to turn to plastics because aluminum would dent and bend, but were not able to do so because of the mold shrink and lack of dimensional stability of most thermoplastics. American Molded has produced over 40,000 pieces from a four-cavity mold, mat finished in gray pigmented fibrous-glass reinforced polystyrene. Each complete reel, composed of two halves cemented together with usual styrene cements weighs ½ pound. The tape which is wound on the reel is 0.250 in. wide and the space between the flanges of the reel must be kept to 0.270 in. to 0.280 in. with an outside deflection limit of 0.015 in. in a 10½-in. diameter.

American Molded Products has found it best to use the material as it comes from the makers with a glass content of 30 percent. They have found that a glass content of 35% requires at least 30° more heat and a relatively long cycle. On present production, front and back heaters of the press are maintained at 700° F. while nozzle heat is 500° F.; and there has been no degradation. By experimenting the company found that an addition of 20% polystyrene accomplished by tumbling would produce better welds but would cause a reduction in dimensional stability of the finished part.

The molder has also discovered that reground material works quite satisfactorily, and that sprues can be fed back into the hopper intact. American Molded Products also has experimented with different types of gates and reports that, provided heats and pressures are properly controlled, either large or small gates will function well.

Heater Fan

The second important piece being molded out of this material is the heater fan for the Studebaker automobile heater molded by Milwaukee Plastics Inc., Milwaukee, Wis., for the heater manufacturer, Master Appliance Corporation, Racine, Wis.

This unit was formerly molded in cellulosic but it was found that the heat distortion point was too low and the fans deformed under load. By opening up the gate from $\frac{1}{16}$ in. to $\frac{3}{32}$ in., Milwaukee Plastics found that the reinforced styrene would run quite satisfactorily. In a two-cavity mold, with each piece weighing 116 g., they are able to run on a 60-sec. cycle with a 500° F. nozzle heat. Two unplated cavities have lost polish but are not unduly worn after producing over 100,000 pieces. The molder is using the material as is with no addition of polystyrene, and finds, as have other molders, that scrap, rejects, and sprues work quite readily. This fan job involves a steel

hub and ring insert, so the very limited shrink of material is an advantage. Through mold redesign it might be possible later to eliminate this insert because of the high modulus of the molding material.

Film Viewer

The third important application of this new glass reinforced polystyrene is in a hand viewer used for inserting 35-mm. and Bantam size film transparencies. The material here became involved with a revolution in viewer design, wherein the old "peek-a-boo" viewers which were held up to one eye against external light are replaced by internally illuminated viewers which yield a magnified image.

Among the newest and most advanced instruments of this type to reach the market is the Admiral Slide Light Viewer, developed by Leonard Afton of Admiral Photo Products Co., Chicago. The use of the reinforced polystyrene material by Moldrite Plastics, Chicago, the molder, gives the viewer remarkable impact resistance, particularly at low temperatures, and improved dimensional stability. Also of interest from the production standpoint is the fact that adoption of this material as a replacement for medium-impact styrene eliminated troublesome sink-marks which had previously been a headache for the molder.

Streamlined for comfortable handling and viewing, the Admiral viewer measures approximately 5½ in. high, 3 in. wide and only 1½ in. thick. Due to its compactness, it slips readily into the pocket for carrying, having no sharp corners to catch or snag clothing. No button need be pressed to illuminate the film; instead, the battery-operated bulb lights automatically when a film is placed in the viewer. The fact that the high quality ground optical glass magnifying lens is mounted at an angle in the viewer makes for greater ease of viewing either vertical or horizontal photo transparencies, since the hand and wrist remain in a comfortable position.

With the exception of such items as the lens, batteries, bulb, metal contacts, and the bolt which joins the two halves of the case together, all parts of the Admiral viewer are injection molded of the glass-reinforced styrene material. The four plastic components include the two halves of the case, the oval collar in which the glass lens is cemented, and the slide carrier, a U-shaped part into which the slides are inserted for viewing. These pieces are produced in a four-cavity family mold on an 8-oz. injection machine.

Identical in exterior appearance, the right and left sides of the viewer snap together firmly, an overlapping bead along the edge of the right half concealing the joint between the two parts. Diagonal slots cored in both sections, near the top, accommodate the film and the film carrier, so designed that it moves a short distance horizontally when the film is inserted and pressed firmly into the viewer. As it slides in mating grooves, the carrier closes a spring brass contact of the illuminating circuit. Upon release of pressure, the carrier retracts slightly and the contact is broken, providing an excellent safeguard against burned-out batteries.

The excellent dimensional stability of the reinforced styrene parts results in warp-free case halves which assemble readily. The two sides are held together by a bolt which screws into an internally threaded brass insert molded into

(*Continued on p. 224*)

Injection Molded Fibrous Glass Reinforced Styrene
Physical Properties—Typical Analysis

	% Fibrous glass by weight			Comparative Values[a]	
				Koppers	*Koppers Modified*
	40	*20*	*10*	*Polystyrene Type 8*	*Polystyrene MC-401*
Specific Gravity ASTM D792-48T	1.33	1.19	1.12	1.05	1.05
Tensile Strength, p.s.i. ASTM D638-49T	11,000	9,000	8,500	8,500	6,000
Elongation in Tension, % in 2" ASTM D638-49T	1.1	1.3	1.5	1.5	11
Tensile Modulus, p.s.i. x 10^3 ASTM D638-49T	1,177	815	692	519	
Compressive Strength at Yield, p.s.i. ASTM D695-44T	15,000	14,500	14,000	14,000	13,000
Flexural Strength, p.s.i. ASTM D650-42T	13,000	11,500	11,000	10,000	9,500
Notched Impact Strength (Izod) (Ft. lb. per in.) ASTM D256-43T	1.8	1.5	0.7	0.3	0.4
Unnotched Impact Strength (Ft. lb. per in.)	4.0	3.4	2.5		5.9
Deflection, Inches ASTM D790-49T	0.06	0.07	0.08	.14	0.4
Heat Distortion, °F.	221	216	214	201	175

[a] These materials contain no reinforcing agents and their values are included for comparison.

BIG PUSH

DOLLS of All Nations, sundae dishes that double as spinning tops, lapel pins, and rings in a variety of interesting, attractive designs . . .

These are but a few of the many types of molded plastic premiums which have been utilized by Tastee Freez Corp. of America in conjunction with a new promotional program recently launched and being continued during the 1954 season by the well known soft ice cream chain. Built entirely around stock items supplied by various molders, the program is said to be the first of its type ever adopted on a national scale.

Studies by Tastee Freez revealed that sundaes in plastic dishes were invariably more popular than those served in the conventional paper containers. After consuming the sundae, customers are permitted to keep the dish for use in the home.

Rounding out the program are a wide variety of other premiums, many of them adopted primarily because of their special appeal to children. The program is designed to aid store operators in stepping up traffic substantially. It will also increase dollar volume because the premiums are geared primarily to the sale of sundaes, malts, and pints and quarts, rather than to cones.

Emphasis was placed on plastics because of the versatility of the materials and the fact that tastefully designed, quality plastic items can be readily and reasonably obtained.

The new "Dolls of All Nations" sundae has proved to be high on the company's popularity list. Bracketed to a molded plastic sundae dish is a doll 2¼ in. high, molded of flesh-colored plastic and hand painted. The entire set consists of 32 dolls, each representing a native of a different country. After the sundae has been consumed, the doll may be easily removed from the dish. The same group of dolls is also molded in jade plastic and mounted on a black ebony base, for use with a matching black plastic sundae dish. The dolls are expected to stimulate interest in collections and trading by the younger element.

Another premium of special interest to children is the "Spinning Top" sundae. It consists of a plastic sundae dish to which is attached a small peg. After the sundae is eaten, the peg is inserted in a space provided in the center of the cup, converting the dish into a spinning top.

Premium with a point: plastics sundae dish (left) becomes useful household container after ice cream has been consumed; doll bracketed to dish handle—one of a set representing 32 different nations (below)—makes colorful, educational collection item

WITH SMALL PREMIUMS

Ice cream chain takes advantage of versatile stock-molded plastics items to build huge merchandising program

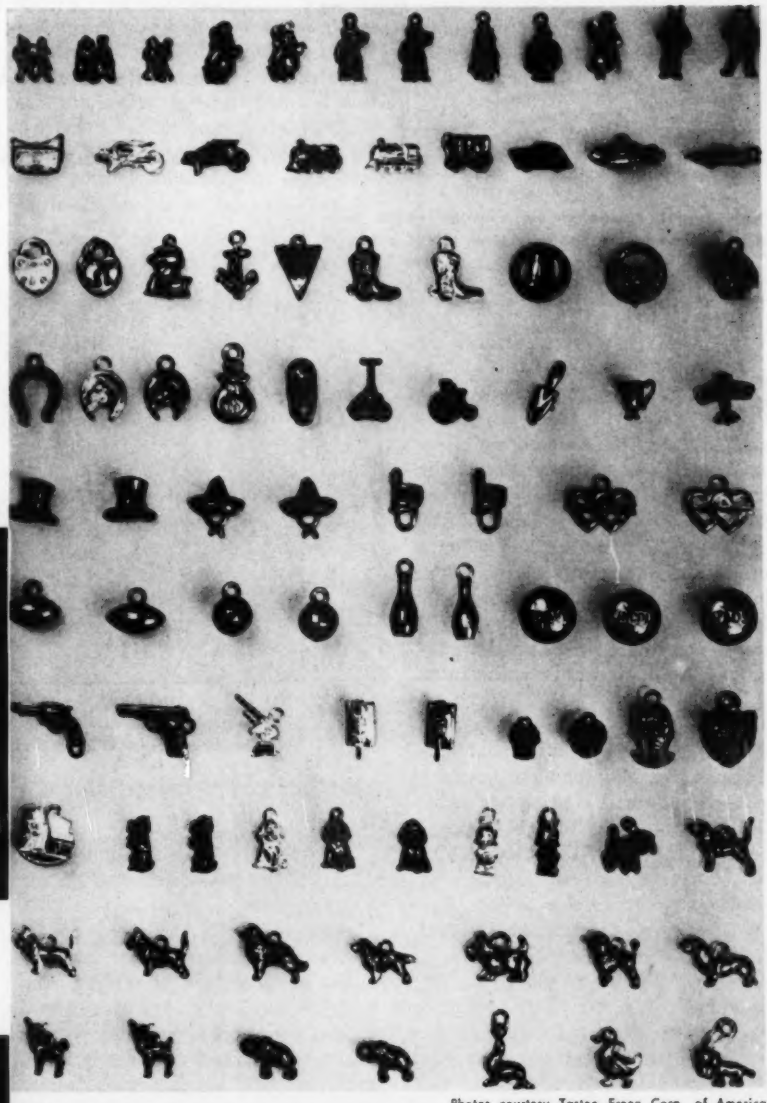
Other items popular with children during the past season were a variety of rings, in simulated silver and gold, and an assortment of charms.

Among additional plastic premium specialties chosen for practicality in the home as well as their appeal with the product are a three-compartment dish suitable for relishes or jellies; sundae dishes in two sizes, useful for nut, candy, cereal, or relish dishes; a double-walled tumbler for cold drinks; milk shake mixers; and plastic pint containers designed for use as refrigerator dishes. With the exception of some of the freezer containers, which are polyethylene, all of the premium items are molded of styrene.

Special point-of-sale advertising material was also prepared to tie in with the new premium promotion. The items will be available at all of the approximately 600 Tastee Freez stores, and at each new store as it opens.

Doubly appealing, small-size sundae dish converts easily into spinning top

Three-compartment ice cream dish will hold jams, relishes, etc. in the home



Photos courtesy Tastee Freez Corp. of America

Plastic charms by the score and in a variety of designs give the younger generation a large selection of premium trinkets from which to choose bracelet pendants

New machine uses electronic scanning device to mechanically engrave halftones from plastic blanks

Printing Plates in Minutes

Low-cost engravings produced on plastic sheets offer newspapers high-speed halftone production with unskilled labor

1 Photograph to be reproduced is placed flat in machine, face down, as first step in the new process of producing mechanically engraved plastic halftone plates

PLASTIC engraving plates, made on a new type machine developed in Europe, are among the newest applications of plastics in the graphic arts field. As used in the Engravaplate machine, the plastic plates are low in cost and offer a number of other advantages. Produced in Germany, the plastic sheets or blanks used in the process are made of hard white vinyl trademarked Nolar and have a thickness of 1/32 inch.

Unlike the equipment used in producing conventional metal engravings, the Engravaplate machine requires no camera or photographic film. Basically, the unit is an electronically controlled engraving device, utilizing the optical scanning principle to guide the action of a hardened steel stylus which cuts the surface of the plastic blank, producing a halftone printing plate in which the screen elements precisely match the tonal values of the original picture. Designed primarily for newspaper and publication printing plates, the machine is factory set to make engravings having 60-, 65-, 70-, 75-, or 80 line screens, thus meeting all requirements for coarse-screen halftones.

The compact unit is fully automatic and self-contained. After the photo to be reproduced has been placed in the machine frame against a glass plate, face down, a Nolar plastic blank of proper size is clamped in position against the back of the photo and the engraving head with its cutting stylus is adjusted to the correct height. The picture frame is arranged in the engraving table in such a manner that both the photo original and the plastic plate are at 45° to the scanning direction.

This angle positioning insures a deeper engraving and matches the angle used in conventional photo engravings. When power is turned on, the engraving table reciprocates in ground guide grooves, permitting the optical scanning system enclosed within the light-tight housing of the machine to scan the photograph with a beam of light. Simultaneously, the cutting stylus moves across the plastic blank.

As the scanning device "reads" each segment of the photograph, its dark, light, and intermediate areas are electronically translated into impulses which regulate the cutting action of the stylus, so that the original illustration is faithfully reproduced on the plastic blank. The scanning and cutting arms move progressively sideways at the end

of each stroke, so that a continuous pattern is built up on the surface of the plastic sheet. Eventually, a complete reproduction of the photograph is engraved on the plate and is easily visible because the colored surface is removed at each point where the stylus cuts through it into the sheet.

With this process, a complete 3-column halftone engraving can be made within ten minutes. The plate is then removed from the machine, turned around and similarly engraved on the back with a wider stylus, providing a relief makeready which expedites the production of stereotypes. Due to the back engraving, the small screen elements of the highlights of the picture are relieved of pressure and enabled to recede during the stereotyping process. This is reported to result in brighter highlights, blacker dark tones and cleaner middle tones in the finished reproduction.

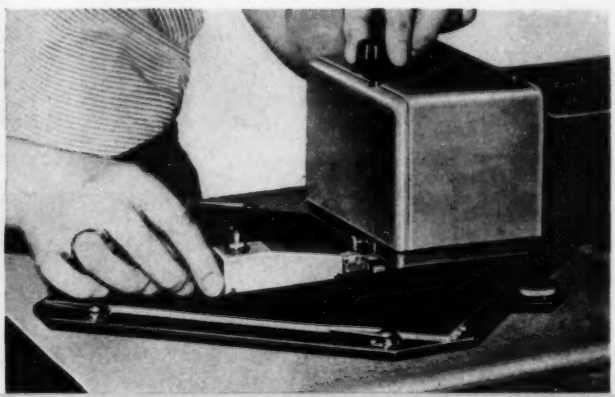
Plastic engravings made by this process can be mounted on a rotary press, used in making newspaper mats, or blocked on wood for use in flatbed presses. It is claimed that they will produce 200,000 or more printing impressions without loss of detail, and cost only one-third as much as zinc plates of the same thickness.

The plastic plates have optimum cutting quality, are light in weight, and resist scratching or damage. In addition, they are non-flammable, easily stored for indefinite periods, and unaffected by the chemical action of printing inks. The flexible plastic plates may be stereotyped cold without difficulty as many as 20 times and may be used in hot stereotyping with temperatures up to 176° F.

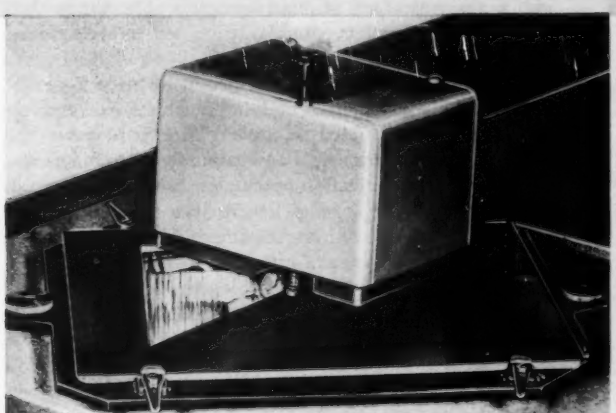
Because of the ease of operation of the Engravaplate machine, which does not require a highly skilled technician, the speed with which the plastic plates may be produced, and the modest operating cost of the equipment, it is believed that the machine will find wide adoption by newspapers, photoengraving plants, and publication houses. Through its use, many small newspapers not having their own plate making facilities will be able to provide their readers with more up-to-date news illustrations and better coverage of on-the-spot events.

CREDITS: Engravaplate machine developed by Dr. Rudolph Hell. Machine is distributed and serviced in the United States by Consolidated Photo Engravers & Lithographers Equipment Co., Chicago, Ill.

2 Hard vinyl plastic blank, 1/32 in. thick, is next placed over photograph and locked in place with four clamps



3 Engraving stylus adjustment is set with gage; light bulb on gage is turned on automatically when stylus is set for proper depth



Photos courtesy Consolidated Photoengravers and Lithographers Equipment Co.

4 Now actual engraving commences and proceeds automatically; above is partially completed halftone of original photograph

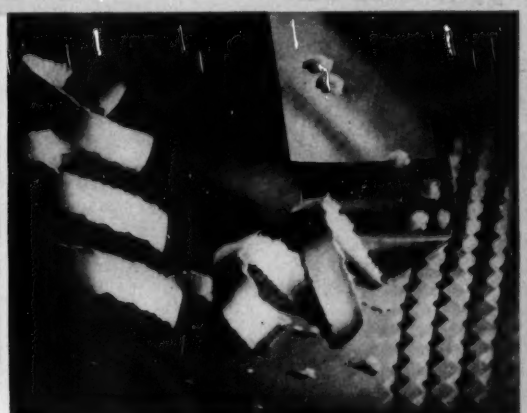
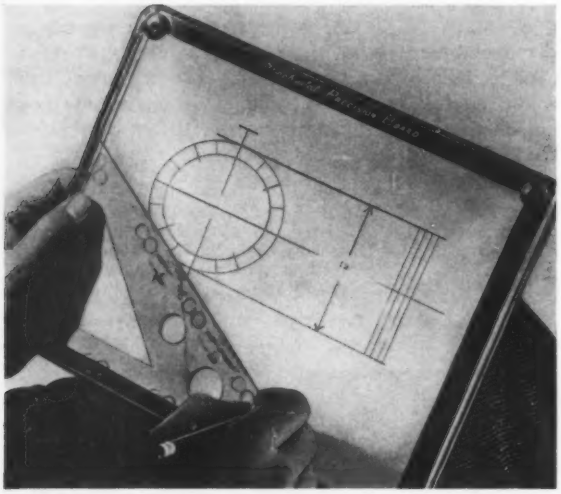


Photo-micrograph of engraving stylus at work; fine plastic shavings are sucked off by vacuum attachment on cutting arm

PLASTICS

Transparent Portable Drawing Board



A portable drawing board weighing less than 8 oz. and molded of clear styrene is small enough to be easily carried in a briefcase. It is recommended for drawing, sketching, tracing, or shadow box work.

Four corner clamps for attaching 8½- by 11-in. paper eliminate the need for thumbtacks. The recessed spring clamps do not obstruct the passage of a triangle or ruler over the surface. Two metal straight edges, one horizontal and one vertical, make a T-square unnecessary, even when doing precision work. Both straight edges are retractable into molded-in channels. Tension clamps on the under side of the board provide for secure storage of triangles. Four rubber pads mounted on the bottoms of the drawing board prevent slipping.

The 9¾- by 12¼-in. drawing board is molded on a 16-oz. injection machine using a one-cavity mold.

CREDITS: Molded by Waterbury Companies, Inc., Waterbury, Conn., for Graphostat Co., 110 Eaton Pl., East Orange, N. J. Styrene supplied by Bakelite Co., New York, N. Y.

Calendar With Magnifier

Flat-type desk calendar holder molded of styrene has a styrene magnifying window in the binding plate that is mounted over the yearly calendar printed at the top of the daily calendar pages. This magnifier not only facilitates the reading of the yearly calendar by providing a magnification of approximately 1½ times, but also gives the complete unit a neater and more modern appearance.

The styrene base or holder is produced in a 2-cavity mold on a 24-oz. injection molding machine. The styrene binding plate is molded separately in two pieces — the clear magnifying insert and an opaque frame to match the base—on a 9-oz. injection machine in an 8-cavity mold.

The clear insert is snap-fit into the frame from the top. A ridge molded along the lower edge of the frame provides sufficient reinforcement to counteract the stress of tearing off the daily calendar pages. Two keyhole slots permit quick removal of the binding plate so that page stubs may be readily discarded.

The desk calendar is available in walnut or gray and holds 5- by 8-in. filler pads.

CREDITS: Molded by Martindell Molding Co., Trenton, N. J. for Ever Ready Calendar Mfg. Co., 160 Maple St., Jersey City, N. J. Styrene Supplied by Catalin Corp. of America, New York, N. Y.

PRODUCTS

Vinyl Light Diffuser

Claimed to provide 30% better light dispersion than glass, the unbreakable rigid vinyl sheet used in a new type light diffuser can be easily cleaned with soap and water. It is attached to any size light bulb by means of a standard wire clip which slips over the bulb. The lightweight rigid diffuser will not dent or crack when dropped; it is fireproof, grease resistant, and has a molded-in design that will not scratch or rub off.

The rigid vinyl sheet is shaped by the vacuum forming process. After the diffuser is formed, the clip is fastened to it by a standard threaded tube which passes through a hole in the center of the diffuser and is held in place by a decorative cap nut.

The diffuser is produced in two sizes, 12 in. and 6¾ in. across. It is available in a variety of patterns, colors, and in either round or square shapes.

CREDITS: Manufactured by Celomat Corp., 521 W. 23rd St., New York, N. Y. Rigid vinyl supplied by B. F. Goodrich Chemical Co., Cleveland, Ohio.

Photo Slide Holder

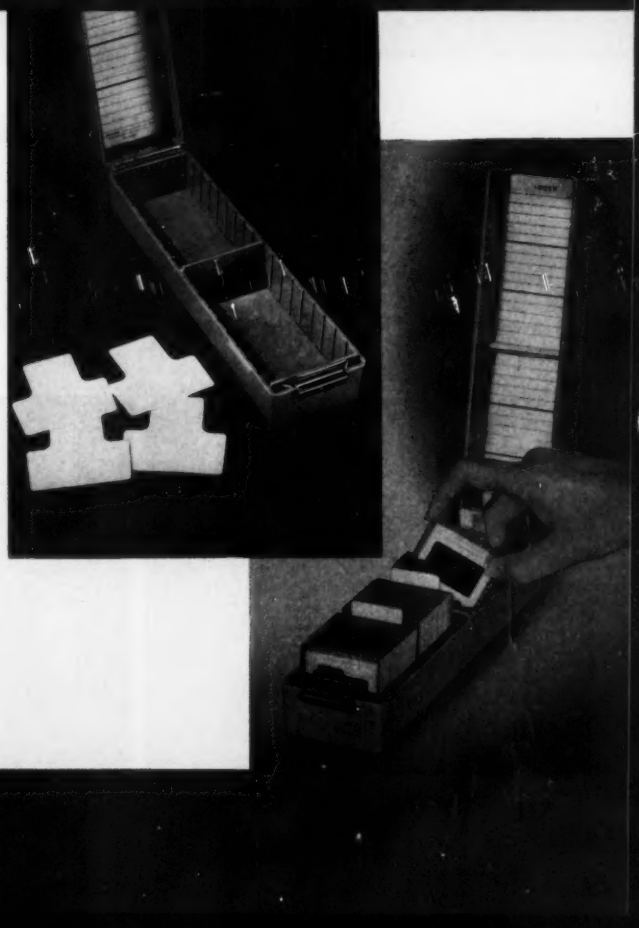
Photo slide holder called Kodaslide Ready-File, molded of styrene, is strong, light in weight, and designed to permit stacking to conserve space. Four movable styrene copolymer index cards plus a molded-in divider provide for filing slides in six separated groups. Indexing slots molded into the holder allow the index cards to be moved to any position and additional cards added.

The Ready-File is produced on a 12-oz. injection molding machine in a family-type mold, with one cavity for the top and one for the bottom. The index cards are blanked out of styrene copolymer sheet material.

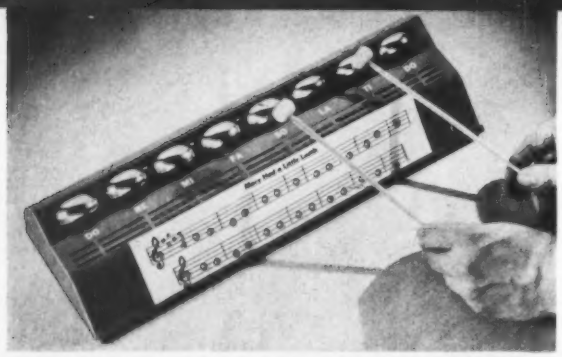
The top and bottom sections of the holder are joined by an off-set metal hinge, the blades of which are pressed into molded-in recesses. Serrated teeth on the ends of the hinge blade bite into the groove and hold firmly without the use of screws, rivets, or adhesives. A metal snap closure locks the two sections together.

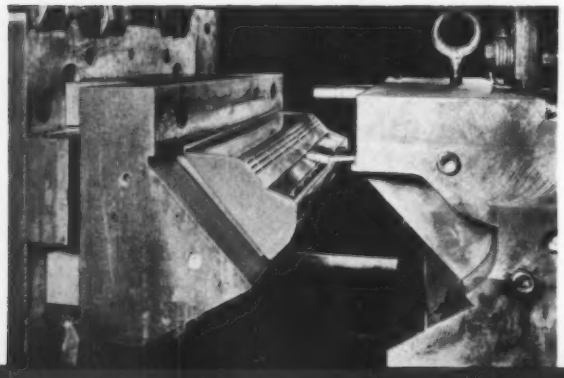
The compact holder will accommodate approximately 200 transparencies or 100 stereo mounts of the 2- by 2-in. size. Slides mounted in glass can also be filed.

CREDITS: Manufactured by Eastman Kodak Co., Camera Works, 333 State St., Rochester 4, N. Y. Styrene supplied by Koppers Co., Inc., Pittsburgh, Pa., Styrene copolymer supplied by The Dow Chemical Co., Midland, Mich.



PLASTICS





Styrene Musical Toy

Called Karimba, a new musical toy makes use of tuned bells instead of metal or wooden bars to produce musical notes. Eight bells, forming one complete octave, are firmly anchored to the console of the toy. The bells are nickel plated to improve both tone and appearance. Molded of high-impact styrene, the Karimba is strong, light in weight, and provides a good sounding board.

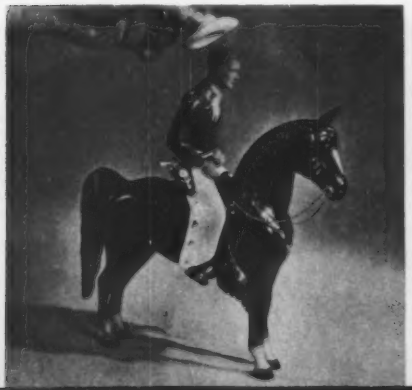
A ridge molded into the bottom of the console serves as a rack to hold music cards at the correct angle while playing. Included with the Karimba are two wooden mallets and six song sheets. The instrument is played by simply following the printed notes and striking the corresponding bells which are clearly marked.

The toy is injection molded on a 12-oz. injection machine using a single cavity mold. Bells are attached by means of riveted metal eyelets. The dimensions are 16 in. long, 5 in. wide, and 2½ in. high.

CREDITS: Manufactured by Kusan, Inc., 2716 Franklin Rd., Nashville, Tenn. Styrene supplied by The Dow Chemical Co., Midland, Mich.

Statuette of Cowboy and Horse

Authentic reproduction of a cowboy and horse molded of cellulose acetate serves equally well as a child's toy or an ornament for a den or mantel. Play value of this statuette is high because the cowboy's hat and pistols are removable and the cowboy and saddle can be taken from the horse. The reins may be hooked to the pommel of the horse or allowed to hang free. The dress, high-heeled boots, ten-gallon hat, six-shooters, saddle, and bridle trimmings are reproduced with lifelike realism. The horse is available in palomino, white, or black. The cowboy is decorated with different color combinations to match the horse on which he is mounted.



The cowboy as well as the horse are molded in sections on an injection molding machine, using cellulose acetate powder as the molding material. The finish is hand decorated and then sprayed with clear lacquer in order to protect it from scratches due to handling or from fading resulting from age.

CREDITS: Molded by Hartland Plastics, Inc., 123 W. Capitol Dr., Hartland, Wis. Cellulose acetate by Hercules Powder Co., Wilmington, Del.

PRODUCTS

Double-Wall Cosmetic Jars

Flexible polyethylene cosmetic jars are one-fifth the weight of conventional glass jars and have excellent insulating properties. Use of polyethylene as the molding material also eliminates the uneconomical factor of breakage.

The jar is molded with a double wall to stop permeation of certain cosmetic ingredients into the container wall. Dead air space created between the walls also provides better insulation for the product than that offered by the conventional cold cream container. The jars will remain flexible at low temperatures, preventing them from cracking if their contents freeze en route from producer to retailer. The insulated jars are available in 1-, 2-, and 4-oz. capacity.

The polyethylene jars are produced in an 8-cavity mold on a 16-oz. injection molding machine. All decorations are hot-stamped.

CREDITS: Sold by Imco Container Corp., 75th and Cleveland Sts., Kansas City, Mo. Molded by Injection Molding Co., Kansas City, Mo. Polyethylene supplied by Bakelite Co., New York, N. Y.

Fibrous Glass-Insulated Ice Bucket

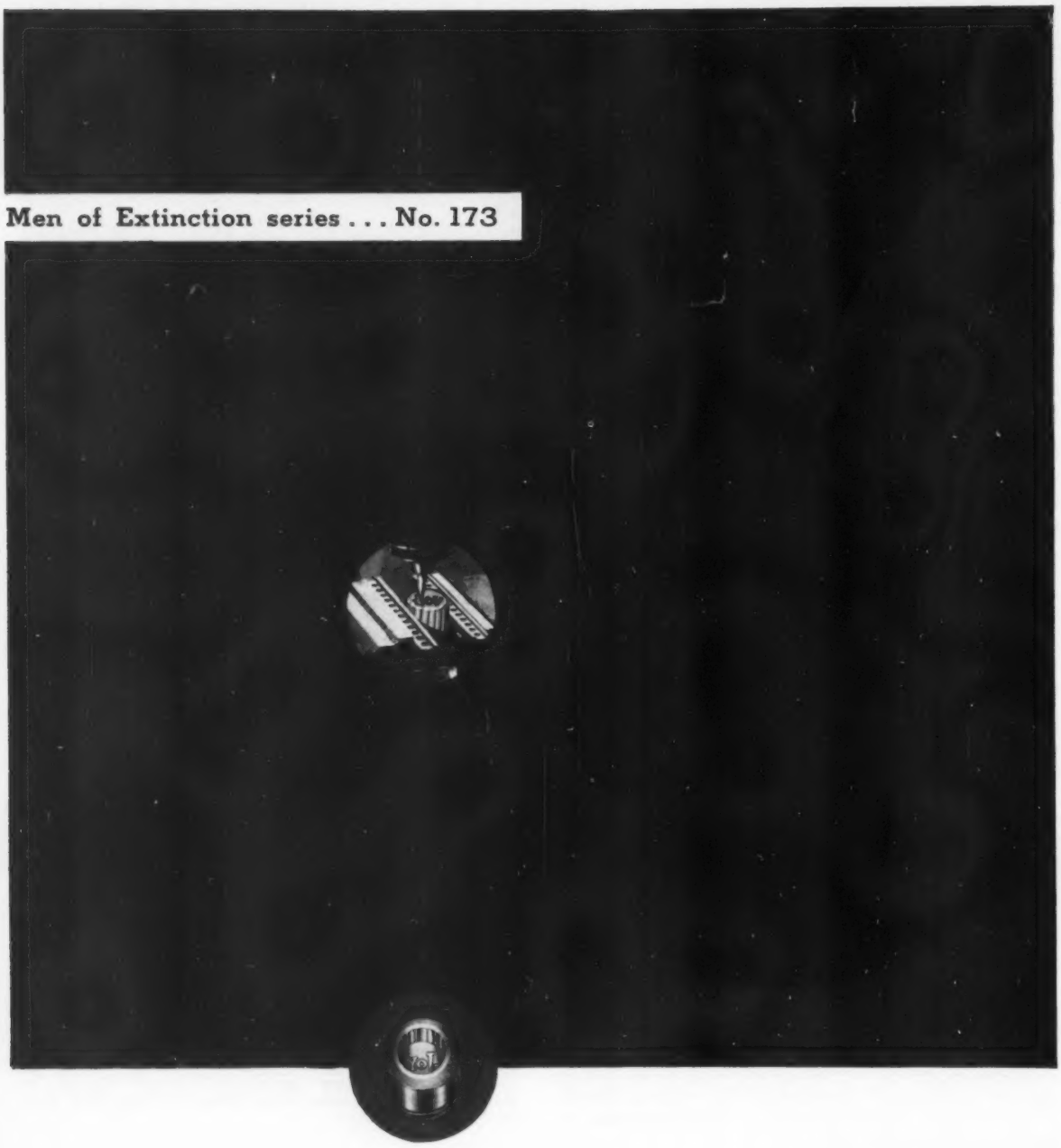
Ice bucket, named Topper, is claimed to keep ice cubes solid for a 24-hr. period. Double-wall construction is obtained by the use of a polyester-fibrous glass outer shell and a molded styrene inner liner which has a capacity of 2½ quarts. Between the two walls is placed ½ in. of fibrous glass insulation. A cover snap-fits in place to seal the bucket. The outer shell is strong, light in weight, and stainproof; the inner liner is made of high impact styrene.

The styrene container is injection molded in a single-cavity mold. Polyester outer shell and cover are produced on a 30-ton press, using a matched metal single-cavity mold.

Phenolic knob for cover is compression molded and comes with recessed thread. Knob is mounted to the cover by means of a brass screw.

CREDITS: Made for Pierson Industries, Ltd., Waterbury, Conn., by Waterbury Companies, Inc., Waterbury, Conn. Styrene by Monsanto Chemical Co., Springfield, Mass. Phenolic and polyester by American Cyanamid Co., New York, N. Y., Fibrous glass by Owens-Corning Fiberglas Corp., New York, N. Y.

Men of Extinction series . . . No. 173



Nickodemus is one of a number of capable people whom we meet when prowling around the premises at MD&E. It is people like Nick who have a hand in making Hobbed Cavities by Midland. He qualifies as a man of extinction because he wants to monkey around triple-checking, thousandths, tens of thousandths, angles, contours, depths, etc. We're busy, and don't have time, but Nickodemus insists. We can't let him go because he owns the micrometer. Such is the situation at MD&E. Wherever sophisticated molders gather, the name Midland comes up when Hobbed Cavities are mentioned. Midland Hobbed Cavities, as you know, are proving every day that two things *are* alike . . . even 16 things . . . even 32 things, plastics units that is. If molding big or small plastics units in uniform multiple quantities, is your business, write Midland Die & Engraving Co., 1800 W. Berenice Ave., Chicago 13. Midland also makes plastics molds, die-cast molds, engraved dies, steel stamps, pantograph engravings.

Illustrations courtesy Westinghouse Electric Corp.

Fig. 1—Clamp with brass insert, V-ring, brush holder, and meter bracket are typical small parts molded of polyester-glass for electric industry

Fig. 2—Non-tacky preforms of putty-type polyester-glass molding compound are made by extruding the material, then cutting it to length

Polyester-Glass Molding Compounds

Considerable skill is required to produce a compound with good flow characteristics and molding properties

by Harry R. Sheppard†

ALTHOUGH the chief application of glass-reinforced plastics has been in structural components of small buildings, automobile bodies, aircraft, and boats, there are a host of relatively small industrial molded parts that can be upgraded through the use of glass-polyester molding compounds if suitable manufacturing techniques are employed in their production.

Several problems plague the molder who works with glass-polyester molding compounds, not the least of these being product uniformity. Glass fibers are structurally one of the strongest materials commercially available today. But if in a molded part these fibers are oriented along flow lines, they provide practically no reinforcement to protect the part against stresses that would tend to fracture it along such lines. It is therefore important that considerable attention be given the manufacture of a molding compound and, more important, the manner in which it is molded, in order to produce a molded part which is uniformly strong.

The polyester resins are usually crosslinked by use of styrene, vinyl toluene, or diallylphthalate. They are catalyzed with peroxide catalysts such as benzoyl peroxide or di-tert butyl peroxide and react exothermically to produce a thermoset material. There are a few properties of the resins, other than their highly important physical, electrical, and chemical characteristics, that are of importance to the compound manu-

* Reg. U. S. Pat. Off.

† Chemical Development Section, Materials Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Pa.

Fig. 3—Shaped to fit mold cavities readily to minimize amount of flow, each preform in this 48-cavity compression mold is used to make a cluster of 12 pieces

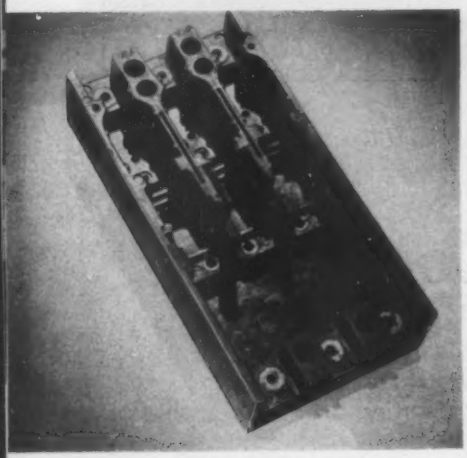


Fig. 4—High-strength glass-polyester circuit breaker base has many inserts

facturer and the molder. They include the following:

	Range
Viscosity (cps.)	100 to 1,000,000
Polymerization shrinkage (%)	5 to 12
Exotherm temperature (°F.)	180 to 475
Maximum heat-distortion temperature (°F.)	77 to 465

Viscosity is important to the compounder because the lower the viscosity of the resin, the easier it is to mix in fillers and the less the glass fibers are degraded. The molder is interested in the flow characteristics of the compound as affected by resin viscosity. In general, the higher the apparent viscosity of the compound, the less porosity there will be in the molded part and the more predictable will be the flow pattern.

The molder does not want a resin with high polymerization shrinkage because there will be a tendency toward cracking and difficulty in maintaining dimensional tolerances. An extremely reactive resin with a high exothermic temperature also produces cracking and dimensional troubles. The molder does want a reasonably high heat-distortion temperature resin so that the part will be rigid as removed from the mold and will not be distorted by stripping forces. Also, with this latter type resin, flash removal is easier.

No attempt will be made in this discussion to pin-point the best combination of resin properties for a molding compound. The properties mentioned above are interdependent on one another and it is up to the resin manufacturer to arrive at a suitable combination for any given molding job.

Fig. 5—High-strength, straw-type glass-polyester molding compound, after having been weighed out, is formed into a ball shape prior to being placed in mold

Glass

The glass reinforcing material should be combined with resin and fillers in such a way as to provide a material with maximum uniformity or homogeneity. Glass in several forms is used today to provide compounds with various properties. Chopped glass cloth or glass mat is frequently used to make a compound when a molder has these materials left as trimmings from laminating operations. Although such reclaimed materials, when used with care, can produce a uniform compound with good molding characteristics, they are not in general commercial use because of their high price.

Glass in the form of chopped roving is used to produce most commercially available glass reinforced compounds. The glass is purchased in 35-lb. balls and can be cut into a mixer containing resin and fillers (or coated continuously and then cut) to provide a molding compound at minimum cost.

Fillers

A wide variety of fillers is used in combination with the glass and resin. The usual function of the filler is to provide better handling prop-

How One Manufacturer Saved 83% on Plastic Molded Parts

Cost per set of plastic timer cams was reduced from 6¢ to 1¢ . . . production per hour increased from 575 to 720 sets . . . savings boosted to $40,000 per year . . . when a Stokes fully automatic plastics molding press was installed at Paragon Electric Company, Two Rivers, Wisconsin.

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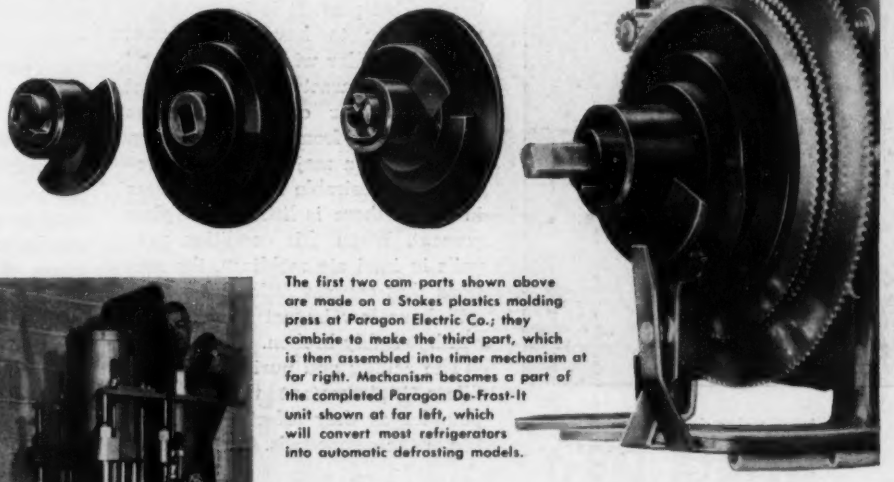
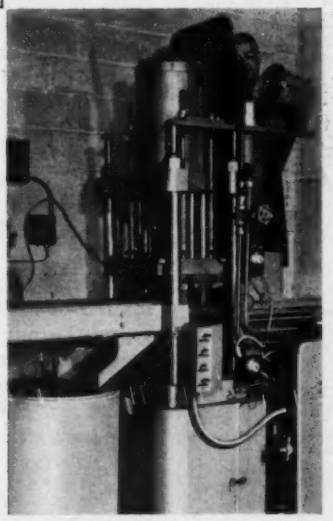


The first two cam parts shown above are made on a Stokes plastics molding press at Paragon Electric Co.; they combine to make the third part, which is then assembled into timer mechanism at far right. Mechanism becomes a part of the completed Paragon De-Frost-It unit shown at far left, which will convert most refrigerators into automatic defrosting models.



Operator fills the hopper of the Stokes Model 741 plastics molding press at Paragon Electric Co. This one operation, performed once every eight hours, is all the attention the press requires.

STOKES

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Fig. 6—Molded fan blade is removed from mold by action of stripper pins

Fig. 7—Large rocker ring was molded of straw-type glass-polyester compound

erties for the compound, better moldability or better properties in the molded part, and lower cost. Although many types of fillers are used, there are several properties which are of considerable importance, both to the compounder and to the molder. These include:

	Range
Oil absorption, cc./100g.	18 to 60
Specific gravity	2.42 to 2.90
Color	unlimited
pH value	6.0 to 10.3
Particle size (microns)	0.03 to 20

It is generally desirable to incorporate large amounts of filler in the resin to reduce tackiness and increase the apparent viscosity so that a non-tacky compound will be produced that can be preformed into shapes of a given size and weight. Fillers also improve the surface of the molded part. It is important to the molder to have the correct amount of filler with the proper oil absorption characteristics to prevent the resin-filler combination from flowing away from the glass fibers. This flow is a major factor in producing undesirable resin-rich areas in which there is little or no glass present. When this condition prevails in intricate moldings, the sections that contain little or no glass will have low impact strength and can be readily broken.

The acidity and purity of various fillers is important to the compounder as they affect the storage life of the compounds. Certain alkaline calcium carbonate fillers cause poor shelf life of molding materials made from liquid polyester resins. On the other hand, certain contaminating materials, particularly some forms of carbon, in fillers may have a decided tendency to inhibit the cure of the resin.

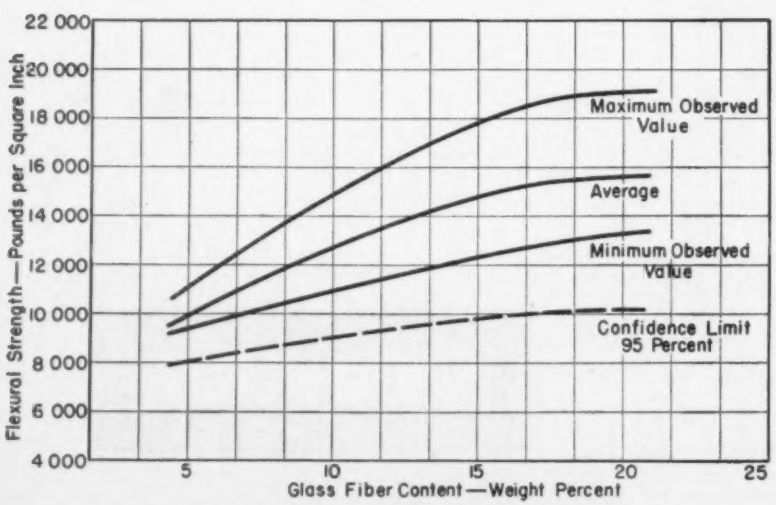

Fig. 8—Flexural strength vs glass fiber content (¼-in. fiber length)

Size and Shape

Particle size and shape are important to the molder because they affect the flow characteristics of the compound. Finely divided fillers such as the calcium carbonates and aluminum silicates tend to allow the resin to flow away from the glass and into small openings in the mold such as occur around stripper pins and parting lines. Fibrous fillers such as asbestos may restrict the flow of resin into small places and in addition tend to hold the resin in with the glass so that they flow together. This is also true to some extent of the needle-like crystals of wollastonite (calcium silicate) or the plate-like crystals of mica (potassium aluminum silicate).

Types of Compounds

Combining glass and polyester resins to make a molding compound is easy to accomplish, and simple parts can be molded from many combinations of these materials (Fig. 1). Most parts are not simple, however, and require considerable ingenuity on the part of the designer, compound manufacturer, and molder to assure a happy customer.

The physical state or condition of the molding compound is one of the most important aspects of a successful commercial operation. For the purpose of this discussion, all glass-polyester compounds will be considered as falling into one of two types: the putty type or the straw type. True, there are many materials that fall somewhere between these two types, but there seems to be little justification for the use of such materials from the molder's point of view.

Putty Type

The putty type of compound is one that can be compressed easily into a shape by hand and will hold that shape indefinitely when the pressure is relieved. This material, when properly compounded, will be non-tacky to the touch. It is capable of being preformed by extrusion and

AIRCRAFT DISTRIBUTOR HEAD molded of MELMAC 592 provides extra safety in ignition system. Chosen for its excellent dielectric strength, arc resistance, insert retention, and resistance to high temperatures. Keeps its properties at high altitudes.
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cut into any conventional simple shape prior to molding (Fig. 2).

In general, the glass content of putty type compounds will not exceed 35% by weight and most frequently they will contain only 5 to 20% glass fibers. The low-glass-content materials generally have exceptionally large amounts of fillers and as such are probably the lowest-cost glass-polyester molding materials available.

As a general consideration it is desirable to compression mold glass-polyester compounds rather than to use transfer molding. Therefore, a putty type material should be preformed into a shape that will conveniently fit the mold cavity so that only a minimum amount of flow is required (Fig. 3). The amount and direction of flow must be controlled by the shape of the preform and the flash lines in the cavity to wash all of the air from the cavity without developing an undesirable flow pattern. Putty-type material, if correctly compounded and molded, will provide the best surface on glass-polyester articles. The surface will be flat and smooth with very little indication of glass orientation lines or flow lines. Putty-type compounds have a very low bulk factor and that of correctly made preforms closely approaches 1.0, or the volume of the molded part.

Putty-like compounds can be molded in various types of molds including positive, semi-positive, and landed positive molds. The type of mold selected will depend primarily on the size and shape of the part to be molded. It is often difficult to obtain suitable moldings from flash-type molds, since the high flow characteristics of the material make it impossible to develop enough pressure on the material.

Many types of small inserts can be molded into parts made from putty type materials (Fig. 4). These inserts must be fastened securely in the mold so that hydraulic forces exerted as the compound flows cannot move them.

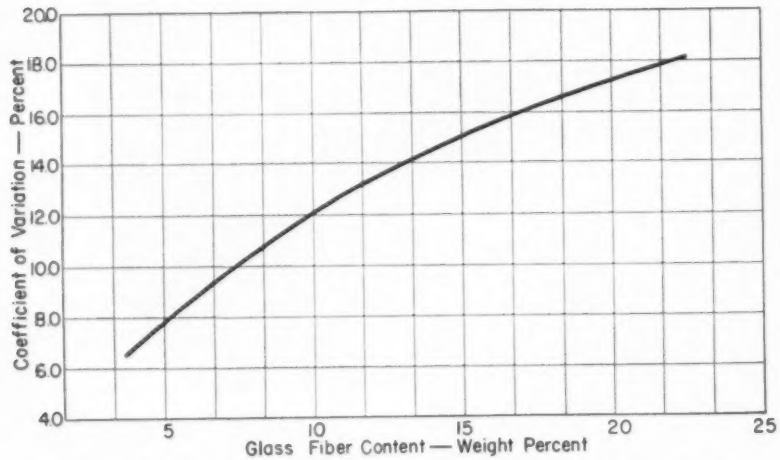

Fig. 9—Flexural strength coefficient of variation vs glass fiber content (¼-in. fiber length)

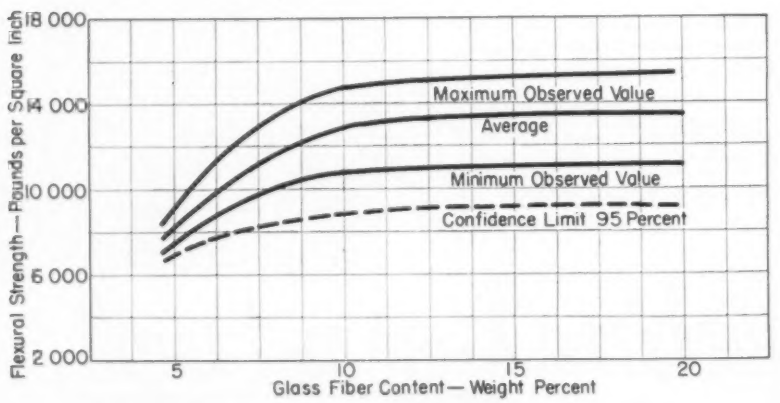

Fig. 10—Flexural strength vs glass fiber content (½-in. fiber length)

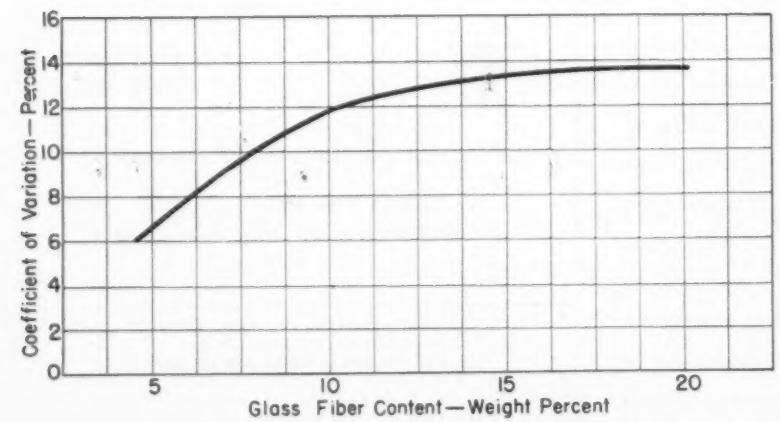

Fig. 11—Flexural strength coefficient of variation vs glass content (½-in. fiber length)

Straw Type

The straw type compounds are loose, random-chopped fibers coated with resin and filler (Fig. 5). They are characterized by a relatively high glass content (from 30 to 60%), are fairly dry and non-tacky, and are generally made using high-viscosity or crystalline-type resins. These compounds have high strength compared with most putty-type materials. They are more difficult to preform, since individual preforms must be made by a compression procedure.

The major advantage of a straw-type compound is that in loading the mold, the glass is well distributed throughout the cavity due to the large bulk factor of the material. When the piece is molded, very little flow is required to provide uniform distribution of the material in the mold and, as a result, there are no

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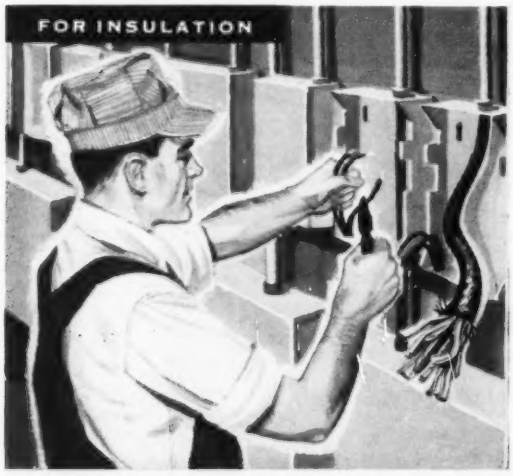

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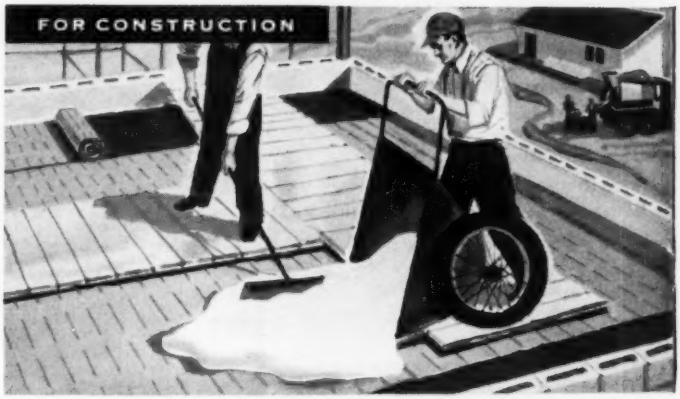

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flow lines and none of the structural disadvantages generally associated with them (Fig. 6).

Because very little flow develops in the material in the mold, it is safe to use it to mold-in inserts that are not securely anchored (Fig. 7). This is particularly true, for instance, where two or more large-diameter wires are to be molded in an electrical part and it is desirable to maintain a small space between the wires to provide electrical insulation. One of the disadvantages concomitant with the use of such a material is that it is necessary to provide a large loading space.

Glass Content

Since the percentage of glass fibers in a molding compound constitutes one of the major cost factors, it is desirable to obtain maximum strength and dependability from the least amount of glass. To obtain information that would help in deciding the optimum glass content, a controlled experiment was performed in which the following variables were held fixed: 1) resin type; 2) filler type; 3) glass type; 4) catalyst; 5) mixer; 6) mixing procedure; and 7) operator.

A series of compounds were made by mixing the ingredients in a 6-qt. sigma blade-type mixer. The materials were added in the following sequence:

Material	*Mixing Time*
1) Resin	0
2) Catalyst	5 min.
3) Filler	15 min.
4) Glass	20 min.

The length of mixing time was determined by the time required to add the material plus time required to make the mixture appear homogeneous.

Two variables were controlled for the purpose of this study: 1) glass fiber length—¼ and ½ in.; 2) glass fiber content—by weight, 5, 10, 15, and 20 percent.

The putty-like compounds so made were compression molded into test bars which were used to determine flexural strength and Izod impact strength according to A.S.T.M. D-229-52. The data so obtained were analyzed statistically to determine the effect of the controlled variables on the flexural strength and impact strength of the materials. For the purpose of this presentation the following statistical concepts were used[1]:

Standard Deviation is a value calculated from the experimental data which measures the amount of deviation of the individual determinations from the mean or average.

[1] Dixon, W. J. and Massey, F. J., Jr., "Introduction to Statistical Analysis," McGraw-Hill Book Co., New York.

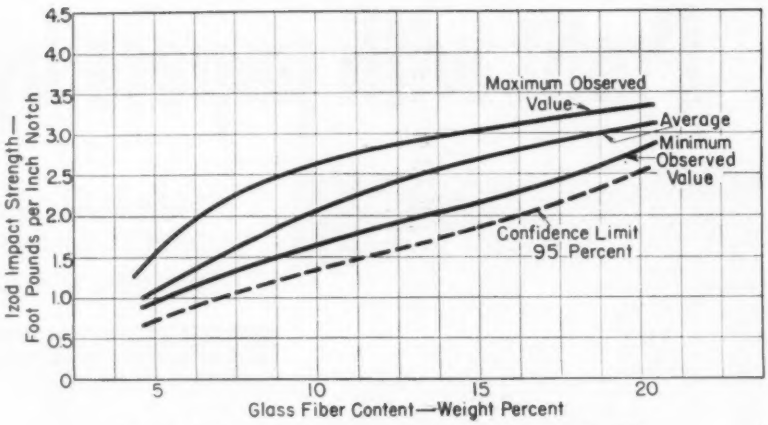

Fig. 12—Impact strength vs glass fiber content (¼-in. fiber length)

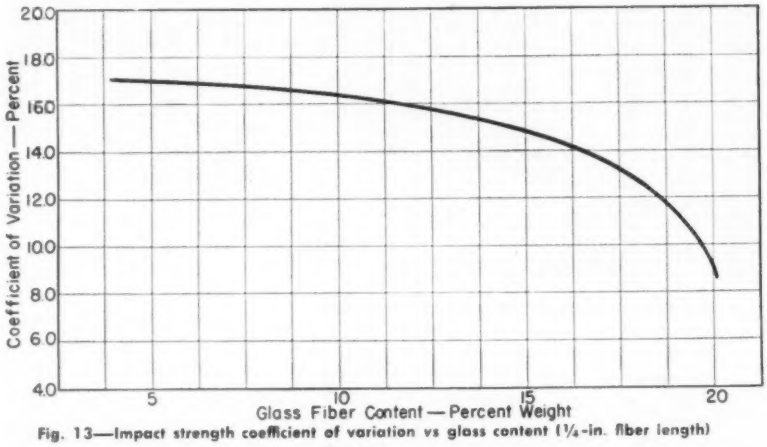

Fig. 13—Impact strength coefficient of variation vs glass content (¼-in. fiber length)

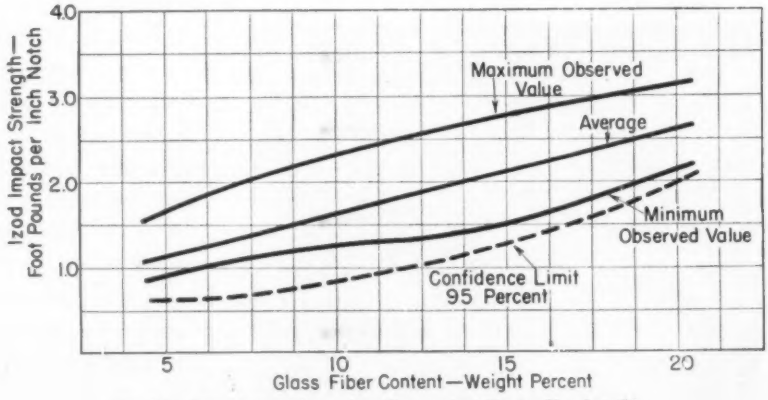

Fig. 14—Impact strength vs glass fiber content (½-in. fiber length)

Coefficient of Variation is a measure of the variation of the experimental data and is calculated as the standard deviation divided by the mean.

Confidence Limit is a value that defines a range of measurements and is calculated so that, with an agreed probability, any experimental data

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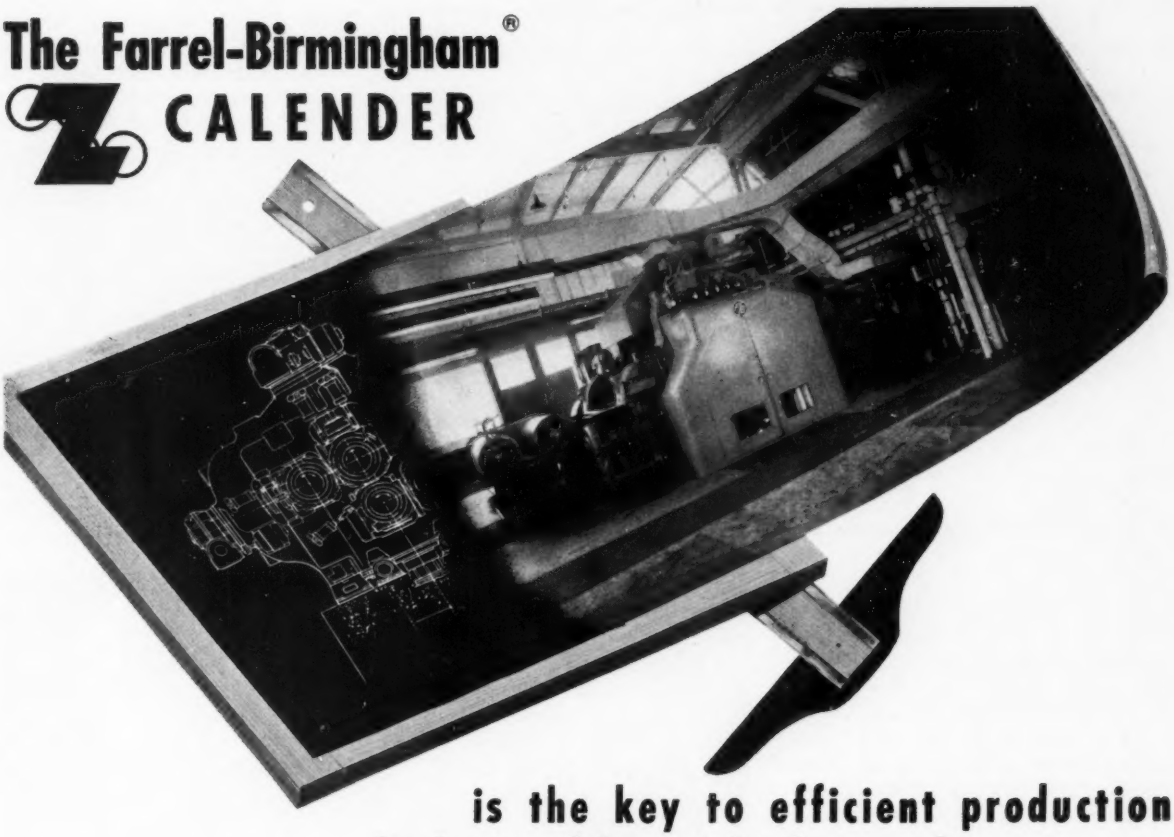

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The origination and development of the "Z" calender by Farrel-Birmingham established new standards for accuracy, quality and speed in the production of plastic film.

This machine performs the delicate task of calendering plastic film at high speed and high temperature, to a gauge as thin as .002" and less, within tolerances of plus or minus .0001". Employing the crossed-axes device on the final pass, this accuracy can be maintained over a considerable range of film thicknesses.

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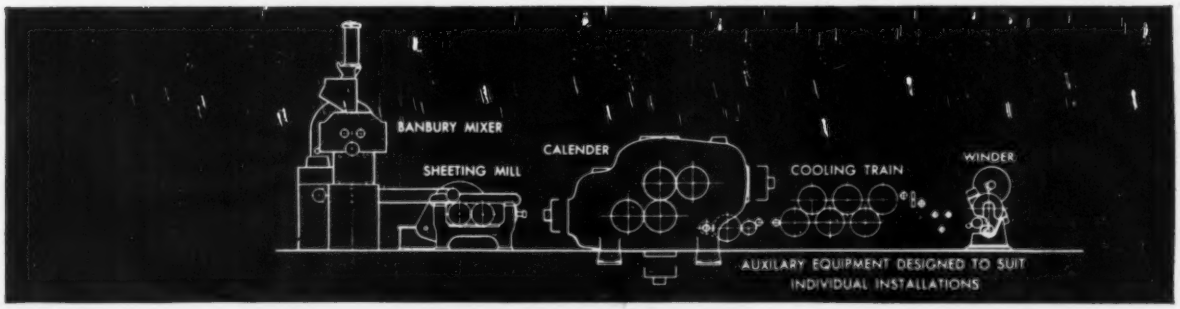

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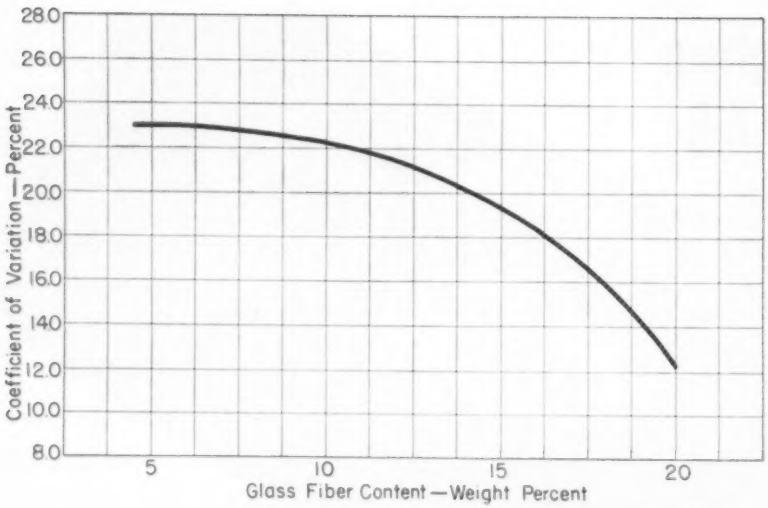


Fig. 15—Impact strength coefficient of variation vs glass content (½-in. fiber length)

½-in. fibers, while the flexural strength of the material using the ¼-in. fibers increased up to the highest percentage evaluated.

The impact strength data for the materials made using ¼-in. fibers (Fig. 12) showed that this property increased with increasing glass content. The variability (Fig. 13) decreased with increasing glass content in contrast with variability in flexural strength mentioned above. The impact strength of the materials having ½-in. fibers (Fig. 14) was less than the corresponding material made using ¼-in. glass fibers. The same reasoning as expressed with regard to the flexural strength comparison would apply here. It was in-

(*Continued on p. 135*)

will be within this range. In the analysis of the experimental data, a confidence limit was used such that 95% (the agreed probability) of all values would exceed this limit.

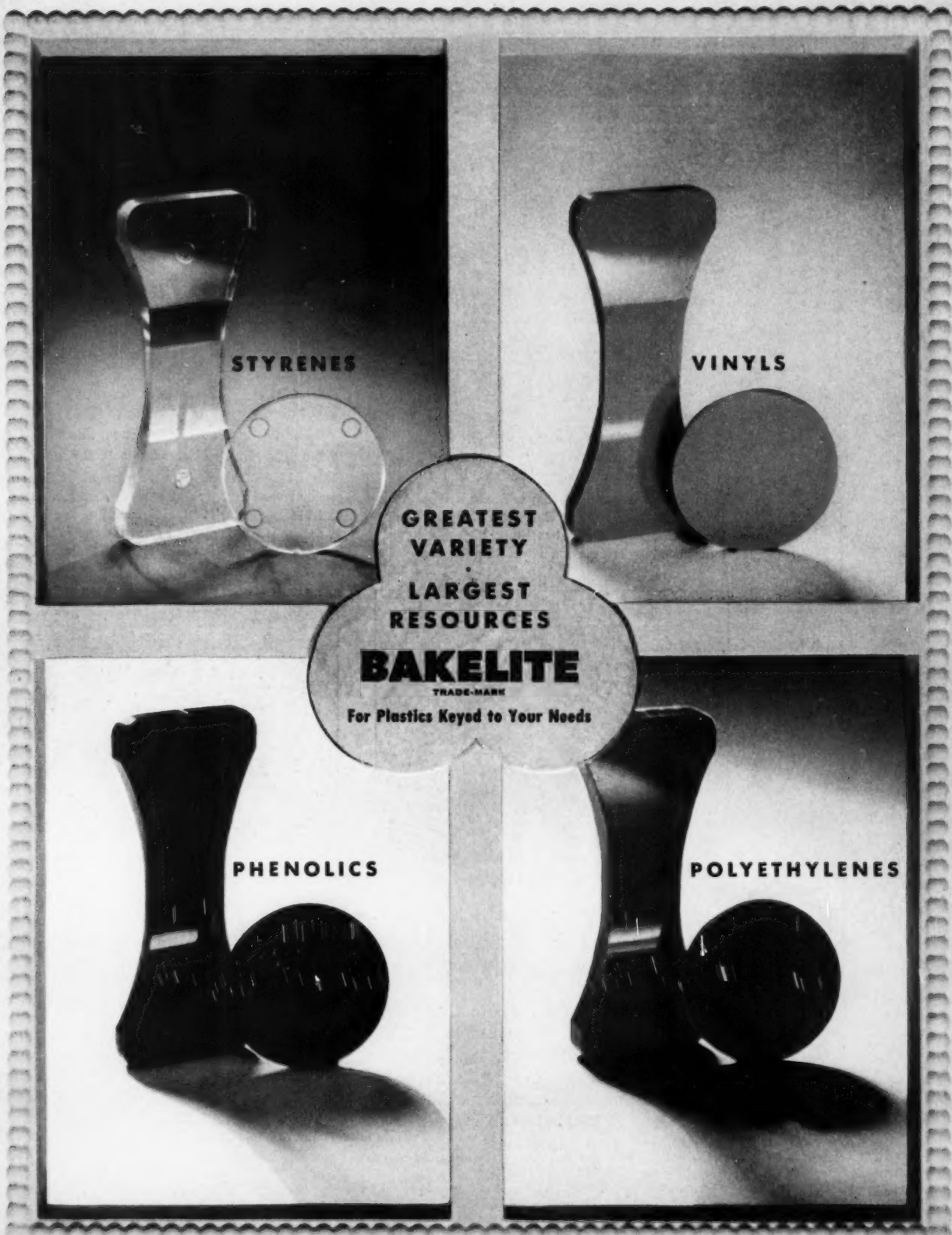
The flexural strength data obtained from materials made using ¼-in. glass fibers (Fig. 8) showed that as the glass fiber content increased the flexural strength increased. In Fig. 9 the plot of the coefficient of variation showed that as the glass fiber content increased, so did the variability of the material. This meant that, although the average strength of the material increased, there were still an appreciable number of parts having relatively low flexural strength. By reference to Figs. 10 and 11, it was shown that the use of ½-in. glass fibers in general resulted in a material with somewhat lower flexural strength than the comparable material using ¼-in. glass fibers. An explanation of this observation can probably be found in the fact that substantially more work had to be done on the ½-in. glass fibers to mix them homogeneously with the other constituents.

Short Fibers

Since work on the material generally results in breaking down the fiber bundles that contribute most to the strength of the material, it is readily seen how the short fibers may have an advantage using this mixing procedure. There was little increase in flexural strength above 10% glass fiber content using the

Fig. 16—General-purpose polyester-glass compound is made in sigma blade mixer; resin, catalyst, and filler are added first, then glass is cut into mixer at controlled rate

Fig. 17—For high-strength materials, Brenner cutter draws glass roving through impregnating bath and through dies controlling resin pickup, then cuts impregnated roving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BAKELITE PHENOLIC PLASTICS

Large size meets low cost in this swivel chair base molded in one piece from BAKELITE Phenolic Plastics.

It needs no applied finish because the color—either gleaming black or rich walnut—is the intrinsic color of the plastic. The molded surface is smooth and shiny. There are no burrs or rough edges to snag stockings and scuff shoes.

The lightweight plastic construction helps make the chair easy to handle. Its compressive strength is so high that the base will support a 3000-lb. load.

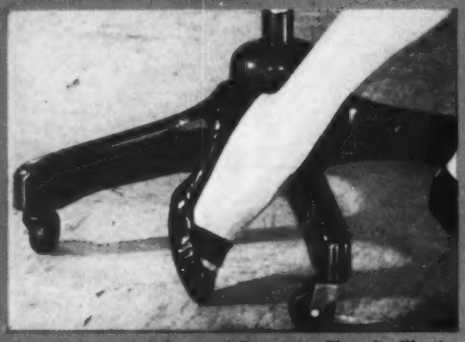
This base is molded from a BAKELITE General-Purpose Phenolic. Other BAKELITE Phenolic molding materials include heat-resistant, higher-strength, and special types for unusual operating requirements.

BAKELITE STYRENE PLASTICS

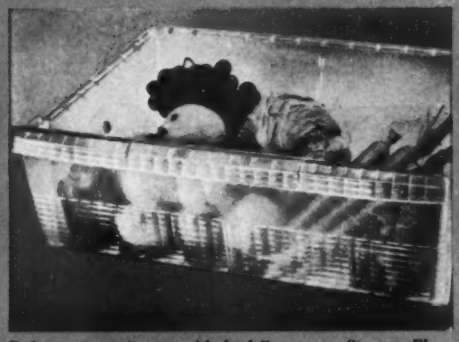
Molded in one piece, this big 40-ounce vegetable crisper fills the whole bottom shelf of a refrigerator. Here's what happened when production was shifted to BAKELITE Styrene Plastic—BMS3-03A-1582.

- *Molding operations were switched from a 60-ounce machine to a 48-ounce machine.*
- *Molding cycle speeded up 13 per cent over what it had been with the 60-ounce machine.*
- *Line pressure was backed down 600 pounds.*

The BMS3-03A materials require lower injection pressures and lower cylinder temperatures than standard BMS3 grades. They fill the mold more easily and are more readily removed from the mold. They are available as clear materials and in transparent colors.



Swivel chairs with bases of BAKELITE Phenolic Plastic are made by **Dependable Mfg. Co.**, Omaha, Neb.



Refrigerator crisper molded of BAKELITE Styrene Plastic by **General Electric Co.**, Decatur, Ill.

Bakelite Company provides a single source for the four types of molding and extrusion plastics that are in greatest demand—phenolics, polyethylenes, polystyrenes, and vinyls

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Its toughness and flexibility are long-lived. It is highly inert—resistant to water, acids, alkalies, chemicals, weathering, and aging. The lightest commercial plastic, it can bring about important weight savings. Superior electrical insulation properties fit it for TV and high-frequency electronic service.

BAKELITE Polyethylene is molded into large-scale articles such as 13-gallon carboys and 55-gallon drum liners . . . and into items as small as washers. It can be given a satiny or glossy texture. It is available in a broad range of pastels and vivid colors. Elaborate patterns can be molded into its surface. It is readily molded and extruded on conventional equipment.

Bottle for Mennen Baby Magic molded of BAKELITE Polyethylene by **Imco Container Co.**, Kansas City, Mo.

BAKELITE VINYL PLASTICS

Deep undercuts are a feature of this injection-molded case for a lapel microphone. They are made possible by the ease with which BAKELITE Vinyl Elastomeric Plastics can be removed from the mold.

The case fits snugly around the microphone assembly, which is readily inserted because the case is easily stretched. The cover, also made of BAKELITE Vinyl Elastomeric Plastic, snaps into place and holds fast. Surfaces have a high gloss, fine details. The color is a dark, translucent tortoise shell.

BAKELITE Vinyl Elastomeric Plastics keep their resilience and flexibility, protecting delicate electrical components. They have excellent dielectric properties, as well as resistance to water, acids, alkalies, oil, and grease.

Lapel microphone case molded of BAKELITE Vinyl Plastic, for **Amperite Company, Inc.**, New York, N.Y.

BAKELITE PLASTICS

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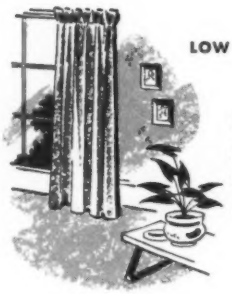
Vinyl resin floor tile, plasticized with FLEXOL *DOP stands up under daily use in playrooms, libraries, kitchens, and retail stores.*



LOW VOLATILITY

Vinyl drapes plasticized with FLEXOL *DOP are still in service after ten years of constant use.*

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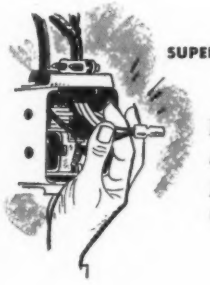
Plastic garden hose containing FLEXOL *DOP does not stiffen through water extraction and withstands long term sunlight exposure.*



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FLEXOL *DOP is the most widely used plasticizer in building wire compounds.*

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teresting to observe that the materials having ¼-in. fibers not only had higher average impact strength than the comparable materials having ½-in. fibers, but also showed less variation as indicated by the coefficient of variation with respect to glass fiber content (Fig. 15).

Where it is necessary to design to absolute minimum values, the average strength has very little significance. For this reason, the 95% confidence limit was shown on each of the physical property graphs. This gives a more realistic basis for the appraisal of the physical property as related to the glass content or fiber length. In general, it can be said that the advantage one might expect to obtain by increasing the glass content of a compound when considering average values, is not nearly so great when considering a 95% confidence limit. This is particularly true of the flexural strength relation. The slope of the 95% confidence limit curve for the Izod impact relation is great enough to warrant the use of more glass in the compound. Unfortunately, the Izod impact test does not give an accurate picture of high strength impact materials, because a considerable amount of work is required to tear the test piece apart after it has been broken.

Since all of the data that have been used as a basis for the above considerations were obtained using standard test specimens, it would be desirable to relate this information to commercially molded parts. Experience has shown that other factors, such as mold design and molding conditions, will sc affect the properties of the molded part that values obtained from standard test methods must be adjusted in the light of these effects. Generally, results obtained from standard test specimens are used for the comparison of materials. When minimum properties are required, however, it is advisable that the molded part should be tested.

Physical Properties

The method used for incorporating glass fibers in the resin is one of the most important variables in controlling properties of the finished polyester molding compound. Several machines were tried and found to be unsatisfactory from a manufacturing standpoint. These included

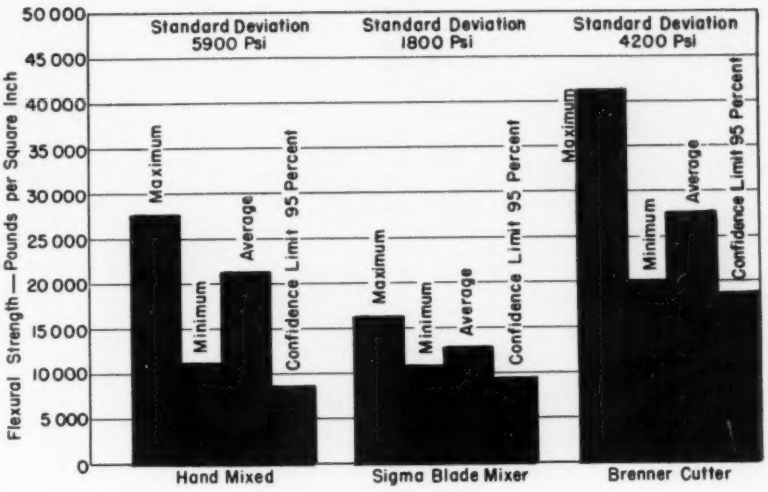


Fig. 18—Flexural strength vs manufacturing procedure

a mix muller, vertical propeller, and vertical dough type mixer. These machines were abandoned primarily because of problems encountered when the glass was added to the other components. A sigma blade mixer and the Brenner cutter[2] were found to be the most satisfactory blenders.

The sigma blade mixer (Fig. 16) was used in a batch process to prepare from 100- to 400-lb. quantities. Component materials were added in preferred sequence and mixed until the compound was uniform. This process was relatively trouble-free but resulted in a low-strength glass-polyester compound.

The Brenner cutter was used for continuously coating and cutting glass roving (Fig. 17). The nature of this process made it necessary that a relatively fluid coating resin composition be used.

Hand mixing was investigated as a process that would least degrade the glass fibers. It was found that the maximum amount of glass that could be mixed in the compound in this way with a reasonable amount of effort was 20% by weight. The material appeared to be uniformly

(*Continued on p. 227*)

[2] The Brenner cutter was developed by I. G. Brenner, formerly of Owens-Corning Fiberglas, Corp. Newark, Ohio. Mr. Brenner is now owner of I. G. Brenner Co., Newark, Ohio.

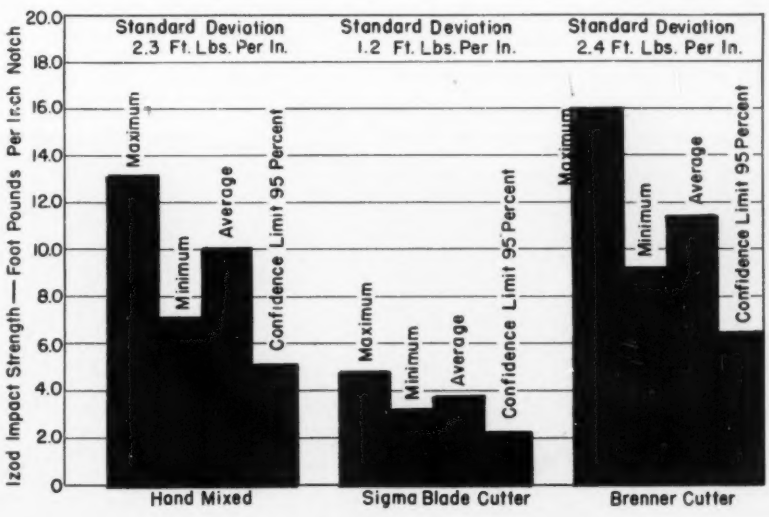
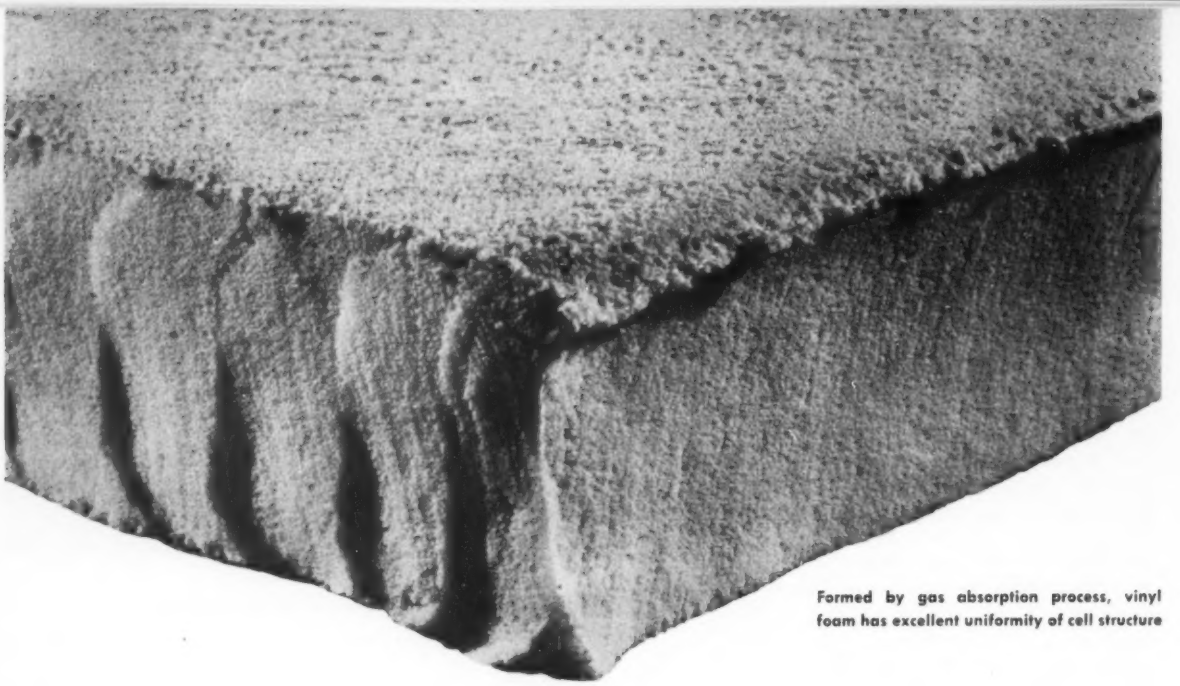


Fig. 19—Izod impact strength vs manufacturing procedure



Formed by gas absorption process, vinyl foam has excellent uniformity of cell structure

Vinyl Foamed With Gas

Low capital investment and low production costs make material competitive with sponge rubber

FOAMED vinyl plastisol produced by a method which uses inert gas instead of a chemically active foaming agent gives promise of competing with foam and sponge rubber on both a property and a cost basis. The new gas-absorption plastisol foaming process has been developed by Elastomer Chemical Corp.,* Newark, N. J. Foamed plastisols have been produced with a density of between 7 and 12 lb. per cu. ft.; by the Elastomer process, foams having a density of as low as 5 and as high as 30 lb./cu. ft. can be made.

Potential markets for this new material parallel those of sponge rubber. In 1953, sponge rubber sales totalled $180 million, which was a 40% increase over 1952; a similar sales increase is anticipated for 1954. And the economy of the new process is pointed up by the statement that it can be put into production with a capital investment of only about 20% of that required for foamed rubber. Ultimate sale price of the gas-foamed plastisol should be much lower than rubber.

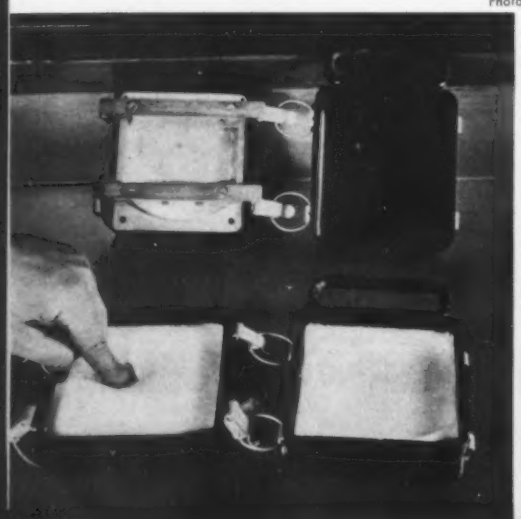
Much of the economy of the production of the gas-foamed plastisol lies in the fact that the material can be cured in molds without pressure. This greatly simplifies mold construction and at the same time eliminates the need for costly press equipment. Curing can be accomplished either in an oven or with

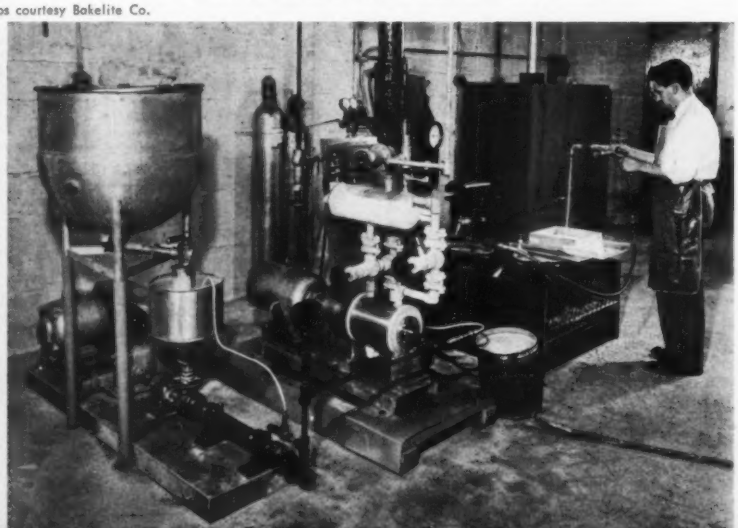
* Elastomer Chemical Corp. holds patents which cover foaming of plastisols with CO_2 or other inert gases in a closed system. Several licensees are or will soon be producing molded articles and sheet stock on a custom basis.

Vinyl foam cushion for an instrument case was formed by using the case as the mold; no pressure was necessary

In continuous foaming unit, a vinyl resin-base plastisol formulation is mixed with an inert gas and discharged as foam into an open mold

Photos courtesy Bakelite Co.





Courtesy Bakelite Co.

Mold containing expanded but uncured foam is placed between electrodes of a high-frequency oscillator where cure will be completed rapidly

Three-in. slab of foamed vinyl plastisol being removed from dielectric oven, where it was cured in 4 minutes

dielectric heat equipment and in either open or closed molds. Also, the material may be successfully formed into a continuous sheet, cured dielectrically.

The gas-absorption process produces a foam that has a number of advantages over chemically blown plastisol sponge. Lower or higher densities, greater uniformity of cell structure, and better compression characteristics are among the more important features. Since expensive chemical blowing agents are not required, material costs are low. Because the new foam may be cured in open molds without pressure, it is possible to foam it *in situ* for padding in instrument cases, etc.

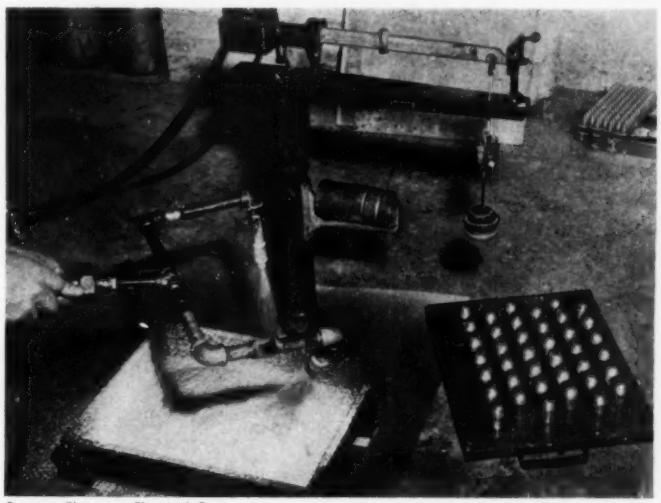
The equipment required to transform the liquid plastisol into foam is relatively simple. The gas, usually under a pressure of 300 to 400 p.s.i., produces a foam which, discharged into the mold in the form of a wet, expanded mass, can be cured into a firm, resilient product. Molds can range from simple cardboard containers to complex metal forms.

After the foamed plastisol has been placed in the mold, it is most practical to cure it by the dielectric method. For example, the developer of the process states that a 3 in. thick section can be thus cured in 4 min., as against almost 3 hr. in a hot air oven.

Three Methods

In the production of foamed plastisol objects requiring two-part compression type molds, the required

(*Continued on p. 140*)



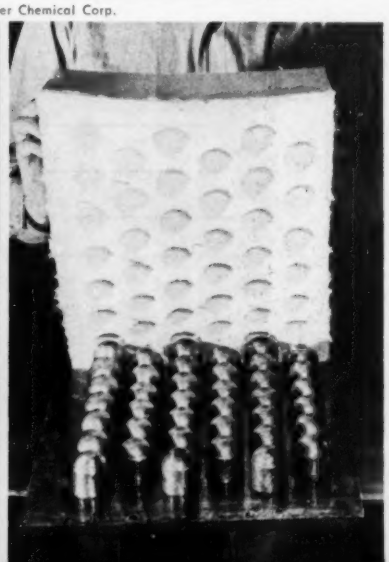
Courtesy Elastomer Chemical Corp.

As first step in production of test section of foamed plastisol mattress, foam is sprayed into mold cavity until required weight of material is indicated by scale

Next, male portion of mold is placed in position, and the material is then cured

After cure is completed, gas-foamed plastisol section is removed from force plugs

Courtesy Elastomer Chemical Corp.



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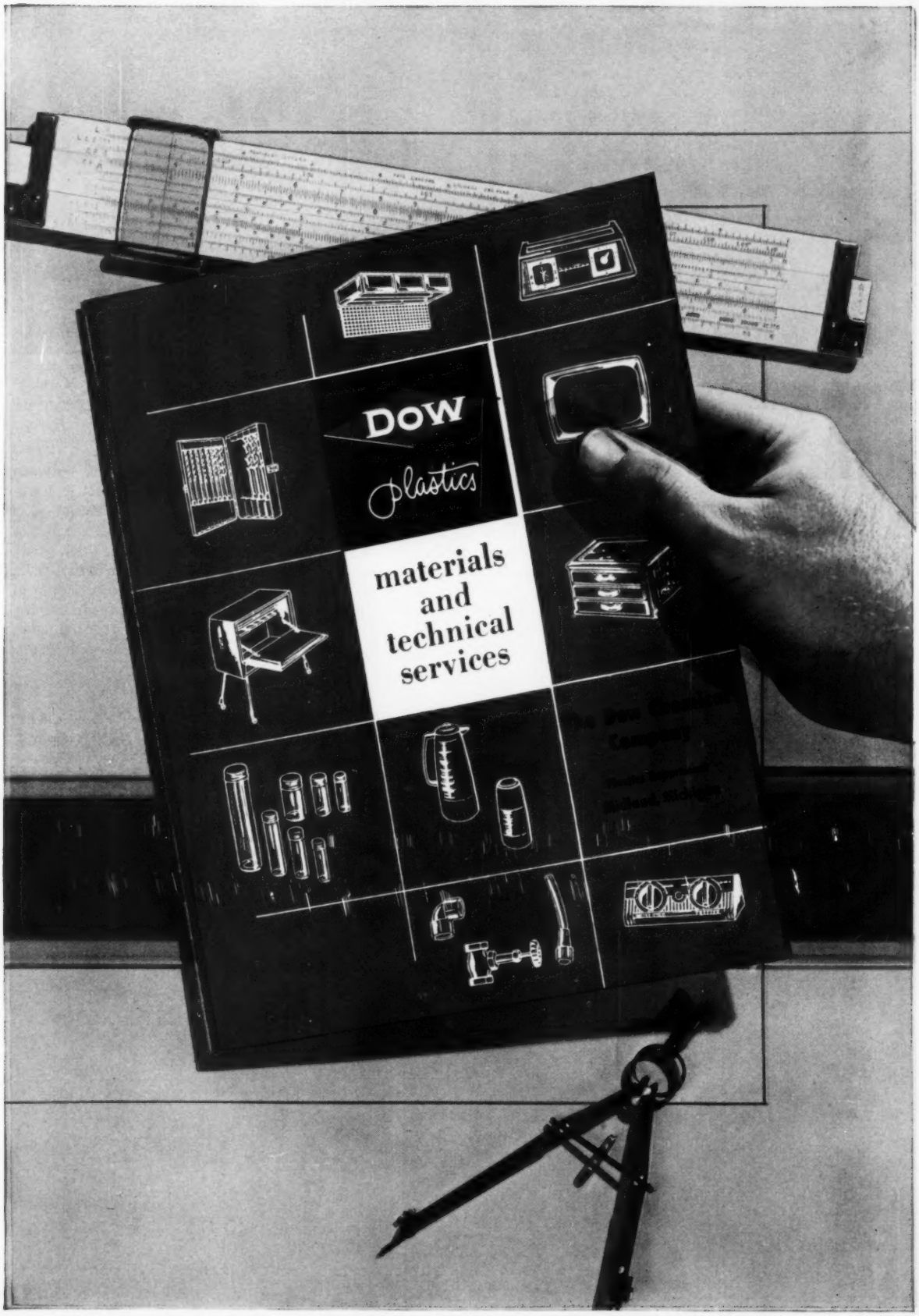
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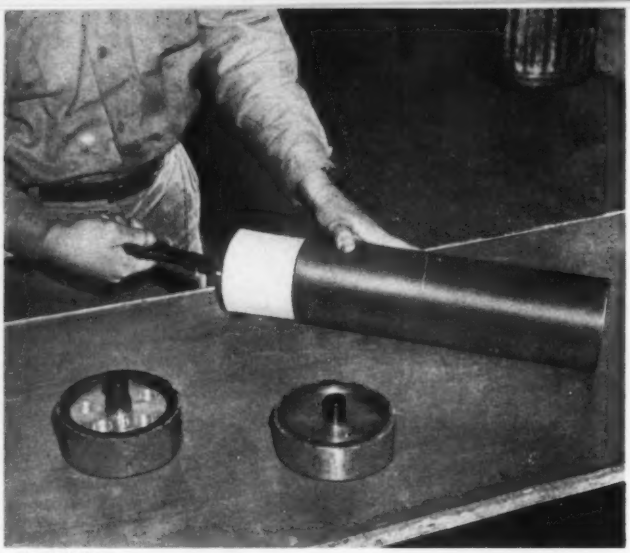

Courtesy Elastomer Chemical Corp.

Printing roller is produced by injecting gas-foamed plastisol into bottom of closed mold until mold is full, then curing it

After cure has been completed, the cylindrical mold is disassembled and the printing press roller, formed of gas-foamed vinyl plastisol, is removed from it

weight of foam is delivered to the cavity by a spray nozzle or a simple tube discharge. The male portion of the mold is then placed in position and the foam is oven cured.

Another method of handling gas-foamed plastisol is to inject it into a closed mold. After the mold has been completely filled, as indicated by material issuing from vents in the top of the mold, the curing step is carried out.

In the production of foamed plastisol sheet by a continuous process, the foam, piped from the mixing unit, is sprayed on a conveyor belt. A second belt then squeezes the material to a predetermined thickness as it passes under a roller. The two belts with the uncured sheet of foam between them pass between the electrodes of a dielectric heating unit, curing the material in a matter of seconds. When using a 5-kw. oscillator, a 1 in. thick strip, 16 in. wide with a density of 8 lb. per cu. ft. can be cured at a rate of 100 lb. per hour. With a greater oscillator capacity, the production rate can, of course, be increased.

Over-all view (left) and close-up (right) of production of continuous sheet of gas-foamed plastisol. Foam from continuous mixer is sprayed on conveyor belt, squeezed to proper thickness under roller by second belt and passed, between the two belts, through dielectric heater for cure

Courtesy Bakelite Co.

Courtesy Elastomer Chemical Corp.

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Maximum recommended casting area in mold	15 sq. in.
Size of die plates	16 x 10 in.

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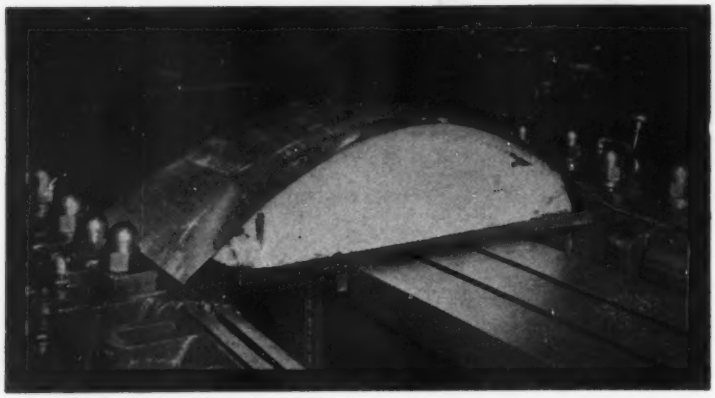
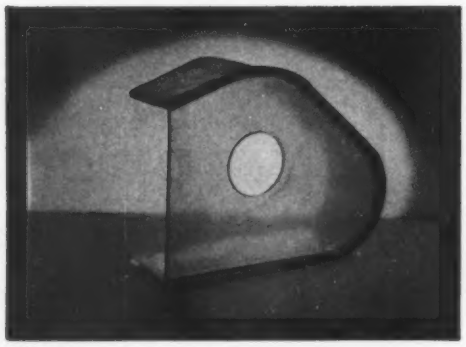
A30

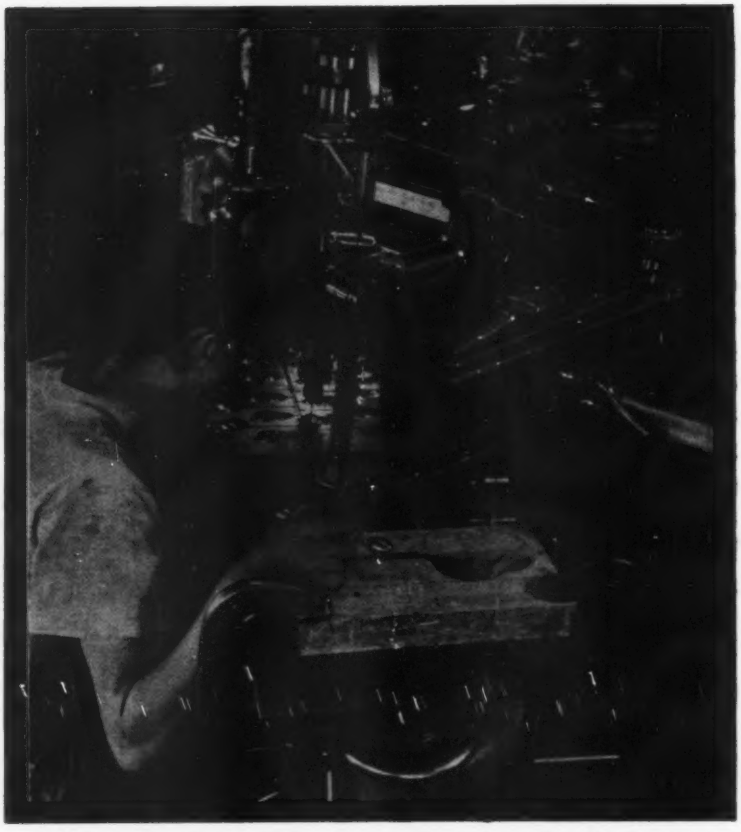
Mold used for contact lamination of fiber glass impregnated with polyester resin. Resin #77 is resistant to heat, will not crack or distort.



Cast stretch-die used in forming aluminum aircraft parts. The high compressive strength of Marblette's resin #71 makes it particularly adaptable to this operation.



Transparent gear housing cast from Marblette phenolic resin #88 demonstrates the excellent light transmitting properties of the Marblette compound.



The stylus of the pantograph is moved over the contours of the pattern, made of Marblette resin #71, reproducing it with complete accuracy in the multiple cavity steel die in the background.

This picture page shows Marblette's Phenolic Casting Resins at work for Tool and Die Men and Foundry Men who believe sound economics make the best foundation for lasting profits.

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Polyurethane Resins

by Johan Bjorksten,† Henry Tovey,† and Henry L. Dollard, Jr.†

The progress indicated by the expanding patent literature in polyurethanes attracts attention to this group of plastics. The German trade literature shows great activity on polyurethanes. In this country, a major chemical company now plans a large scale manufacture of isocyanates, key material in urethane resin production (3)[1]. It appears timely, therefore, to examine the present status of the technology of polyurethanes as it may relate to materials available or likely to become available to American industry at progressively lower prices.

Inasmuch as a survey by Otto Bayer, a pioneer in this field, was published in *Modern Plastics* in 1947 (4), this review will be directed to developments subsequent to that year, with only a brief orienting introduction.

THE polyurethane resins are obtained by reaction of diisocyanates with substances that have at least two groups containing active hydrogen, such as hydroxyl-, amino-, oxime- and peptide-groups. Diglycols, diamines, and alkylol amines are now commonly used. This reaction takes place readily at room temperature. Thus, the polyurethanes are generally made by admixture of two components shortly before use, although recent developments have gone far to remove this limitation. The raw materials are simple, easily mass-produced chemicals, so that cost should come down when sales volume increases.

Polyurethane resins exhibit an uncommon versatility. They can be drawn into fibers, foamed, molded, used as adhesives, elastomers, and in coating and textile treating compositions. These applications of the polyurethanes will be discussed below.

Fibers

The advent of nylon induced an effort on the part of I. G. Farben to produce similar fibers on a different basis (14,16,24,25,32). The linear polyurethanes, obtained by reaction of 1,4-butylene glycol made from acetylene and 1,6-hexane diisocyanate, gave fibers of strength in the same order of magnitude as the nylon fibers, but differed from them by having water adsorption in the order of 1.6 to 3.6% against 17% for nylon, as well as better weather resistance and electrical properties. On the other hand, their melting points were much lower than that of nylon resins (150 to 200° C.), the spinning was difficult, and the range of applicable dyes was limited (15,16,19,21, 37).

The newer patents on polyurethane fibers include two to Dreyfus (27,28), on fibers from compounds, containing two urethane radicals reacted with monoethanol amine and from N,N'-dicarbophenoxy-2,4-diamine toluene and hexamethylene glycol. Two other patents, also assigned to the Celanese Corp., give a method for preparation of fiber-forming polyurethanes from bis (chloroformates) and diamines (30, 31). Buckley and Rey prepared polymeric ureas capable of fiber forming (26).

Some work is being done now on the relation of molecular structure of polyurethanes to their fiber-forming properties (13,17,18,20). Patents have been issued or applied for on preparation of twined filaments from polyurethanes, and on processes matting the fiber and making it resemble wool (33,35,36).

Foamed Materials

When isocyanates react with carboxylic groups, and when water is added to polyester-diisocyanate reaction product, carbon dioxide evolves with the production of amide and urethane linkages (38). The water may be added in the form of a metal salt hydrate (39). This reaction is ideally suited for preparation of foams having a wide range of cell size and of physical properties.

The foaming reaction is exothermal, and gives a temperature and pressure increase sufficient to complete the curing of the polyester component (49). Adhesion to a wide range of substances is excellent, which increases the utility of this foam as a core material for sandwiches (48). Another promising application of foamed urethanes is as filling for inflatable toys.

This process is applicable to the elastomeric as well as to the rigid urethane resins. The molecular weight of the polyester employed for condensation with the isocyanate plays an important part in determining the properties of the foam (50, 51).

Aluminum-filled urethane polyester foams are available on the German market, and the Monsanto Chemical Co. has entered this field here. Mixtures of various polyesters, and phenol-aldehyde diisocyanate modified resins have also been disclosed recently (44,47).

Simon and Thomas of the Lockheed Aircraft Co. disclose the use of metal soap powders, alone or with metal leafing powders, to improve foam stability, and thus make pos-

---

* Reg. U. S. Pat. Off.
† Bjorksten Research Laboratories, Chicago, Ill.
[1] Numbers in parentheses link to references at end of article.

sible a lighter foam of high final strength (40). A similar result is obtained by using quaternary ammonium bentonite complexes and ethyl cellulose in conjunction with the alkyd polyester resin polyisocyanates (42,46). The polyurethane foams are compatible with flame retardants such as the allyl aryl phosphonates (41).

By using as the diisocyanate component a diisocyanate prereacted with a relatively minor proportion of the polyester material, or by using polyisocyanates containing hydrolyzable chlorine, it is possible to extend the time before foaming starts, and also to minimize the amount of free diisocyanates, which could constitute a hazard unless well ventilated (43, 45).

Application of the foamed material requires mixing and material handling equipment adapted to this task. An ordinary lightning mixer is suitable when properly arranged and adapted to the size of the mixing container.

A spraying type mixer has been developed which mixes the diisocyanate and the polyester separately on the one hand, and water and activator on the other, and then brings these two systems together in a final mix chamber, from which the compound emerges in a low viscous state, ready to foam (80).

When the components are sprayed under high pressure into a very small mixing space, it is possible to mix all the components in a single chamber (52). This makes possible small portable foaming tools, adaptable for use on the production line, in shipyards, or in the building construction industry.

In these operations care must be taken not to expose the polyester-diisocyanate mixes to atmospheric humidity prior to foaming, as this exposure could cause them to gel prematurely.

Molding Compounds

Molding compounds were among the first materials developed on a urethane basis, and patents were issued on phonograph records and printing plates (55,56). The basic developments were completed several years ago, and relatively few new developments have been forthcoming in recent years.

The basic limitations from a molding standpoint are the limited storage life of the mixed polyester isocyanate compound, the toxicity of unreacted diisocyanate, the limited storage life, and the necessity to avoid moisture for at least the diisocyanate component. For these reasons it is unlikely that the urethane resins will supplant present principal injection- or compression-molding materials, even though price should become attractive and even though mechanical and electrical properties and heat stability are good.

For injection molding urethane resins it is necessary to use machines in which the clearance between the heating cylinder and the torpedo is small, and the capacity is such that just enough material is heated to fill the die. Procedures and machines for blow molding of polyurethane films are given by A. Romanowski in a recent article (53).

Polyurethane resins, in the form of foamed material, find increasingly frequent application in the manufacture of radomes for use on military aircraft

Courtesy Zenith Plastics Co.

Adhesives

Quite generally polymerization in the presence of the material to which a substance is to be adhered favors a good bond. Also, the diisocyanate component is so reactive that it is very likely to find groups of attachment on adjacent surfaces (69,76). Polyurethane resins often adhere to glass so firmly that the glass surface breaks off before the adhesive bond yields. Therefore the urethanes are logical choices for the production of adhesives (58,62,65,67,70-72). Where an excess of diisocyanate has been employed, all reactive hydroxyls will be covered and water sensitivity therefore is low.

The limitation of the urethanes here again is in the low storage life of the components after mixing. However, these objections are being overcome with the acceptance of room-temperature-curing catalyzed resins for other purposes and with the development of reactive diisocyanate-carrying compounds of relatively slow action.

The urethane-based adhesives are very effective on metals which are capable of forming oxide coatings, such as steel, aluminum and magnesium (8,63), as well as on glass and many plastics. They are among the very few adhesives effective for Buna rubber. Based on elastomer type products, single component adhesives have been developed (75,77). These still have the disadvantage of high sensitivity to atmospheric moisture, which causes them to skin over prematurely. Of interest is the method of Windemuth and Bock (78). This entails the use of adipic-glycol type polyesters having molecular weights in the order of 3000 to 6000 and a hydroxyl number of 40 to 50, extended by reaction with toluene diisocyanate. Before use these compounds are cross-linked with polyfunctional diisocyanates, which lead to quick drying. These compounds are proving of interest in the shoe industry.

Of some relevance in this connection are the allyl carbamate type polyester compounds covered in a recent patent to E. Kropa (135). These compounds are stated to be usable as adhesives, in addition to other functions. An interesting meth-

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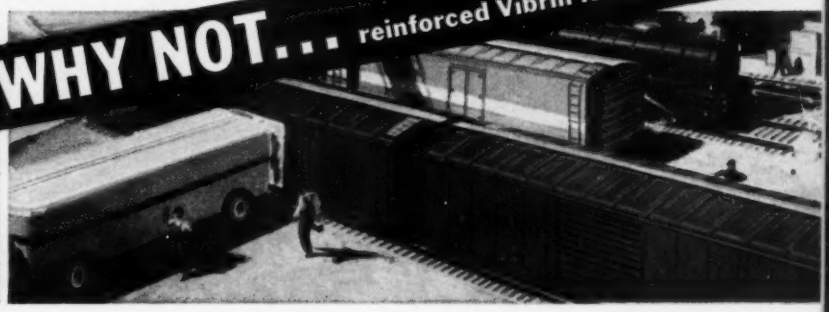

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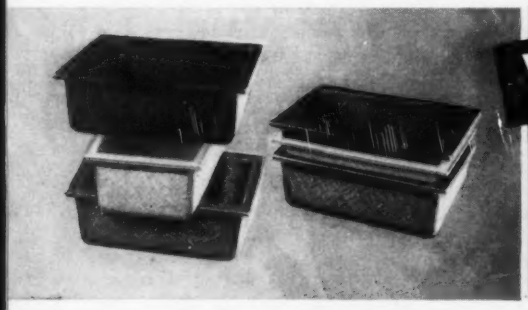

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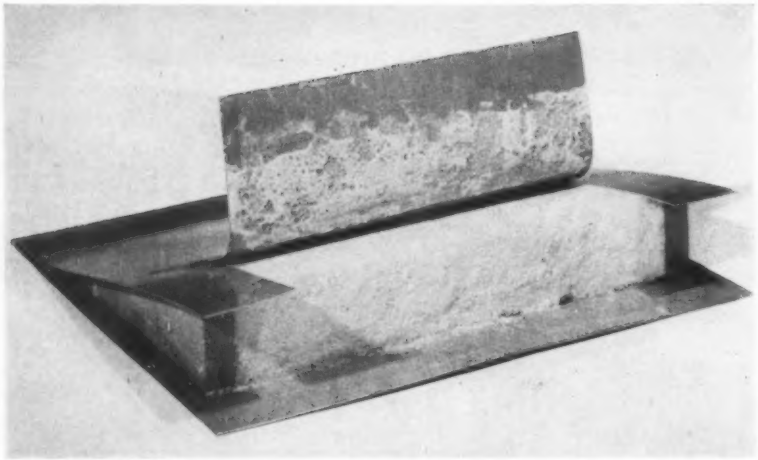

Courtesy Armour and Co.

Section of an aircraft wing trailing edge, filled with foamed polyurethane. Use of this material results in improved structural strength as well as in vibration damping

od of preparing urethane type resins without the use of diisocyanates is patented by F. Strain (73). This method, based on the reaction between alkyl carbonates and allyl or vinyl chloroformate, gives a variety of reaction products, some of which are reported suitable for adhesive use. The shrinkage is reported to be "exceptionally small."

A polyurethane is also used to bond moldings of thermosetting resin to metal objects for electrical purposes (74), and for bonding synthetic fibers to rubber in tires.

Elastomers

The field of elastomers is by far the most active application for urethane resins. The German Vulcollans, which opened this field (80), and Goodyear's Chemigum SL are the practical results of research in this direction. Technical data on the latter product were presented by R. P. Dinsmore before the Washington Rubber Group in March 1953 (81). Basically, glycol-adipic polyesters are combined with naphthalene diisocyanates to further lengthen the chains, and these are cross-linked by reaction with water, glycols (85,97,98,112,114) or diamines (80,96,97,98), or amino alcohols (95, 97) which react with further amounts of diisocyanate; or the active chemical endings are determined and then reacted with a calculated amount of diisocyanate to cause cross-linking. In this step the addition of glycol or diamine in small, controlled amounts eliminates the incidence of objectionable gassing (92).

It is possible to cast elastomers of this type in liquid form. This, however, precludes compounding of the conventional type (111).

The load-carrying capacity of urethane elastomers is almost twice that of oil-extended GR-S. Ozone resistance, and particularly resistance to aging at 212° F., are outstanding. Detailed data are given in Dinsmore's paper (81). Adhesion problems and compounding are only partially solved and need additional work.

Considerable attention has been given to the control of the rate of cross-linking or curing. From the standpoint of manufacturing technique the necessity for control is obvious. By selection of the particular glycols, diamines, or of water, on the one hand, and of the particular isocyanate on the other, it is possible to vary the curing time over very wide limits (93,94,95).

The production of specific articles from the polyurethane elastomers has, so far as is known, not yet been made continuous. However, the mixing and addition of the cross-linking material can be carried out in a warm press which has been adapted for extrusion. Therefore, continuous operation appears basically feasible.

Where batch processes require relatively slow setting, this can be accomplished by the processes indicated above (94,95,111). The liquid reaction mass may be added to a heated revolving form, and the cross linker may be added in this form to effect the final cure.

By the glycol method compression molding is feasible. A combined casting-pressing process is also employed, by which the completely mixed mass, to which the cross-linking glycol has been added, is cooled to room temperature. It will retain its thermoplasticity for several days, and within this time can be formed or pressed, and heat-cured (9).

Benzoyl peroxide, nitro-compounds, quinone oximes, chromates and dichromates, and potassium have also been employed for curing elastomeric reaction products of polyesters and diisocyanates (90,101,106). Formaldehyde, or formaldehyde-producing compounds, in conjunction with compounds which are neutral at low temperatures and acidic at high temperatures, were also disclosed as curing agents for polyurethane elastomers (89,91,102,103, 104,105).

Proteins, partially hydrolyzed polyvinyl acetals, and cellulose derivatives were disclosed by Harper, Smith and White as other modifiers of elastomeric polyurethanes (107, 108,109). Sulfur can be used to vulcanize these products (88,89), and diisocyanates can be used to vulcanize natural and synthetic rubber (110).

Coatings, Resin Treatment

In the surface coating field the isocyanate-urethane type coatings show excellent adhesion and resistance to chemicals and abrasion. Nonetheless, they have not yet been accepted generally because of hazards in handling the isocyanate component and because of the inconvenience of using two component systems.

These difficulties are being overcome. By using, instead of the straight isocyanates, reaction products of isocyanates with about half an equivalent of polyester material, and by adding to this mixture tertiary amines (48,122), it has been possible to furnish diisocyanate carriers that represent substantial improvements in handling time and care required.

Allyl carbamate resins are reported useful as lacquer ingredients (132). In these resins the polymerization presumably occurs mainly by addition polymerization of the allyl groups.

Applications such as wire coating and insulation are logical in view of the excellent dielectric properties of these resins. This problem has been

(*Continued on p. 228*)

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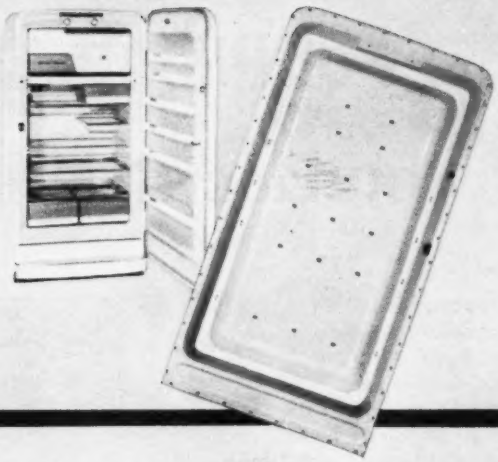

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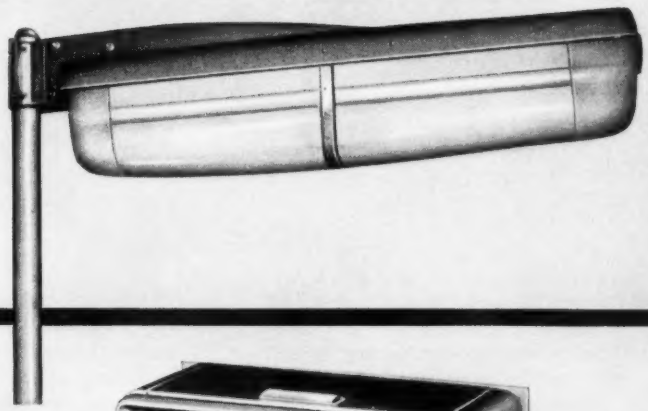

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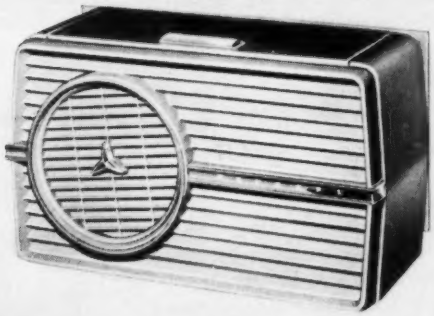

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Effect of Pile Radiation on Electrical Insulation

by John W. Ryan*

THE success or failure of an electromagnetic pump used to circulate a liquid metal coolant in a nuclear reactor may well depend upon the ability of the insulation involved to withstand high fluxes of gamma radiation and high temperatures for long periods of time. The purpose of this study was to determine the effect of in-pile radiation on some representative insulating structures.

A survey of the unclassified literature reveals a possible correlation between chemical composition and the ability to resist high-intensity radiation. (1-8).[1] Highly phenylated structures appear to be more radiation resistant than aliphatic structures. Plastics, rubbers, resins, and varnishes represent complex mixtures whose properties are dependent on the quantity of plasticizers, accelerators, anti-oxidants, and fillers used in manufacture. The materials tested in this program were the simplest of their type, and wherever a choice between materials had to be made, preference was given to the material with the greatest aromatic characteristics. Halogenated materials were not included because they evolve corrosive halides.

The Oak Ridge and Brookhaven samples were given an in-pile exposure of 30 days. The use of these two piles made possible a comparison between the effects of pile radiation and heat, since the Brookhaven pile is operated at 160 to 180° C. and the Oak Ridge pile at 25° C.

Using a value of 2.8×10^5 neutrons/cm.^{2}-sec.w., the total radiation received by each can in the Oak Ridge pile is as follows:

Can No.	*Kilowatt hours of irradiation*	*Total NVT*
1-4	2.4×10^6	2.3×10^{18}
5	2.6×10^6	2.5×10^{18}

The Brookhaven samples were irradiated in hole E-36 where the thermal neutron flux is in the order of 3×10^{12} neutrons/cm.^{2}-second. The total irradiation of the Brookhaven samples was about 6.3×10^{18} NVT.

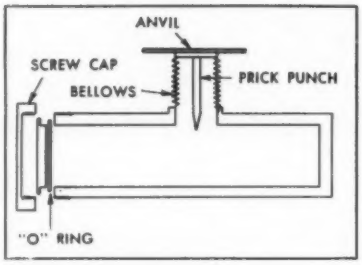

Fig. 1—Gas extractor apparatus

Testing Procedures

Abrasion resistance was measured by the method of Mathes (9), using ten specimens. Contamination of air and personnel was minimized by enclosing the abrading mechanism inside an acrylic box. The loading of the Carboloy washer was accomplished by use of a pulley mechanism connected through a small hole in the top of the box. No contamination of air or personnel occurred in any of these tests.

The tensile strength apparatus (Instron) pulled the samples apart at a constant rate of strain. Contamination was prevented by enclosing the central portion of the test sample in a thin rubber membrane which retained all the particles that were formed on breaking. Three specimens were tested and the results averaged for each test point reported.

The elongation and creep properties were measured by the method of Mathes (10), using six specimens. This test was designed to measure

Table I—Description of Materials Tested

Material number	*Composition*	*Reason for choice*	*End use*
9555	Oil-modified phenolic varnish	One of the better baking varnishes	Treatment of stators, motors, magnet wires, relay coils, generators
81132	Silicone resin	Heat-resistant properties	Class H insulation structures
11523	Silicone-glass laminate	Heat-resistant	Class H insulation structures; terminal boards
2076	Phenolic-glass laminate	A good heat-resistant commercial laminate	High temperature (200°C. max.) laminate
3552	Mica tape bonded with #81132 silicone resin	Represents one of the better mica tapes	Class H insulation structures
Phosphoasbestos paper	Impregnated with inorganic silicone oil	A mechanically weak impregnating medium	High-temperature impregnating medium
Fiberglas	Silicate tape	One of the better inorganic tapes	High-temperature impregnating medium

* General Electric Co., Schenectady, N. Y.
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Shore Hardness—A	92	92	92
Clash & Berg T_4 (1)	+5°C	+7°C	+6°C
SPI Volatility (2)— 70°C, % Loss	0.45	0.86	0.43
Calculated % Total Plasticizer Loss	1.3	2.6	1.3
Water Extraction (3) % Loss	1.3	1.2	2.1
Calculated % Total Plasticizer Loss	3.8	3.7	6.5

** based on current listed market prices of plastics materials*

(1) *Torsional Stiffness—10,000 psi*

(2) *Activated Carbon—specimen 20 mils thick*

(3) *Method of E. F. Schulz, ASTM Bulletin No. 183, July 1952, p. 75*

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Table II—Observations of Appearance and Condition of Irradiated Insulating Materials

Insulating Materials	*Color change*	*Crazing*	*Cracking*	*Comments*
Exposed at Oak Ridge				
Silicone (#81132) cable coils	Turned dark brown	Slight	None	Embrittled
Penolic (#9555) " "	" "	"	Slight	"
Formex " "	" "	None	None	Appeared good except darkened
Silicone-glass (#11523) laminate	" "	"	None	Embrittled
Phenolic-glass (#2076) laminate	" "	"	"	Very radioactive
Phosphoasbestos paper	None	"	"	Very radioactive
#3552 mica tape	"	"	"	Good
Silicone (#81132) impregnated #3552	Turned dark brown	Slight	Slight	Mica unaffected
Exposed at Brookhaven				
Silicone (#81132) cable coils	Turned green	Heavy	Slight	
Phenolic (#9555) " "	Black	Heavy	Heavy	
Formex " "	"	None	Flowed	Flowed enough to show copper
Silicone-glass (#11523) laminate	Dark brown	"	None	Embrittled
Phenolic-glass (#2076) "	Black	"	"	
Phosphoasbestos paper	None	"	"	Very radioactive
#3552 mica tape	"	"	"	
Silicone (#81132) impregnated #3552	Resin turned green	Slight	Slight	Mica relatively unaffected

the ability of a varnish to resist flow and stretching when used as an impregnating medium in electrical coils on rotating apparatus.

The device that was used to extract the gas from the aluminum containers that held the samples during irradiation is shown in Fig. 1.* The extractor was attached to a vacuum system and a gas sampling bulb which was used in subsequent mass spectrometer analysis of the gases.

Dielectric strength measurements were made on a 50-kv. hi-pot set which raised the voltages at a constant rate of 1 kv. per second. Six determinations were made for each material. Precautions were taken to prevent contamination of personnel and the atmosphere.

Observations of color, texture, odor, and general condition of the samples were made when the containers were opened.

Materials Tested

The composition and end uses of the materials tested are listed in Table I, p. 148.

* Figure 1 appears on p. 148.

Table III—Cable Coil Deformation and Creep (580-g. Load)

Impregnating varnish	*Treatment*	*Deformation value*	*Creep value*
		%	%
9555 (oil-modified phenolic)	Control	0.082	0.005
	ORNL irradiated	0.073	0.015
	BNL irradiated	0.150	0.001
	Heat aged	0.108	0.005
81132 (Silicone)	Control	Runaway	Runaway
	ORNL irradiated	0.150	0.030
	BNL irradiated	0.230	0.004
	Heat aged	0.320	0.026
Formex (Polyvinyl formal)	Control	0.260	Runaway
	ORNL irradiated	0.215	0.001
	BNL irradiated	Runaway	Runaway
	Heat aged	Runaway	Runaway

Seven-strand cable coils[2] were made from 10-mil ECH17 Alcoa aluminum wire. The wire was double glass-served and then twisted in such a manner that the resultant product was a cable coil specimen consisting of a center wire with six other wires wrapped around it at a pitch of 3 inches. The cable coils were mounted on a jig and then dipped in an appropriate varnish (adjusted to a viscosity of 270 centipoises with an appropriate thinner), drained, and cured. As the next step following the curing operation the dipped cable samples were cut into

(*Continued on p. 155*)

[2] Samples were prepared by E. L. Mincher.

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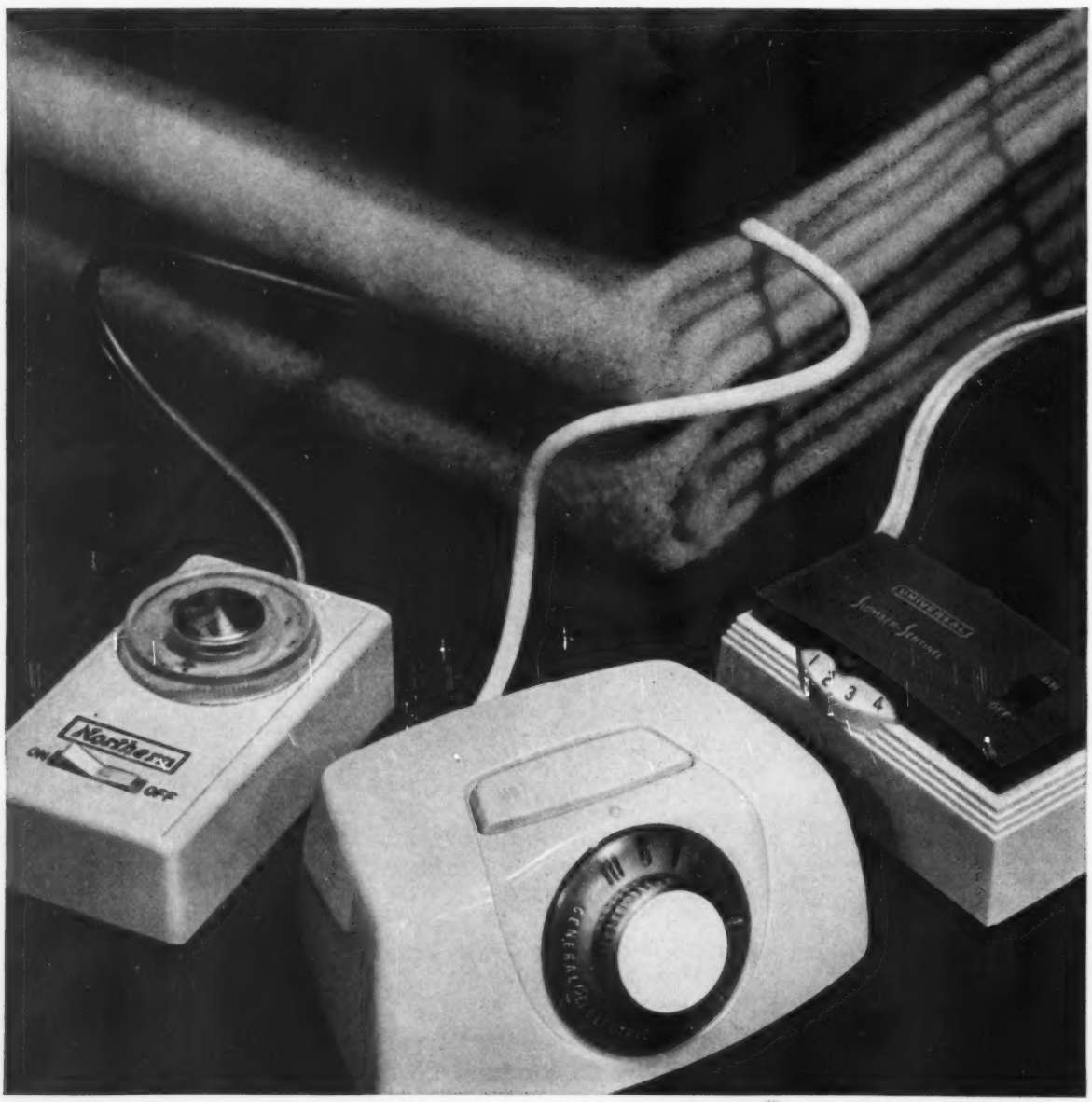

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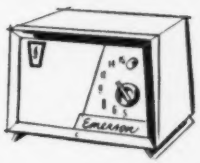
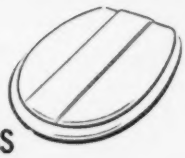


Strength and surface hardness

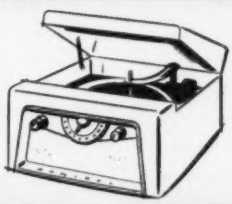


Durability

Color

Translucency

Moldability



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4-in. sections prior to being prepared for the various tests.

Abrasion resistance test specimens were prepared by wrapping Owens-Corning Fiberglas tape around a 2S aluminum bar (⅜ in. square, 3 in. long). The wrapped bars were then impregnated, drained, and cured. These specimens were also used for dielectric strength tests.

Tensile strength specimens were prepared by machining sheet stock laminate into the dumbell shapes in accordance with A.S.T.M. specification D 229-46.

All specimens were wrapped individually in aluminum foil to prevent their flowing together during irradiation. The specimens were then placed in a 2S aluminum container and sealed in a nitrogen atmosphere with an inert arc weld.

Test Results

The test results are presented in Tables II to VIII, inclusive. (Tables II and III appear on p. 150. Tables VII and VIII on p. 156.)

Formex has a short operating life at 160 to 180° C. It is not surprising, then, that the Formex samples irradiated at Brookhaven failed to pass the elongation and creep tests. The Oak Ridge specimens became rigid as evidenced by these data. This increase in rigidity is as expected, since the primary effects of radiation result in the formation of cross-linkages and gaseous products. These results indicate that Formex should be considered for low-temperature, high-flux operations.

Elongation and Creep

The elongation and creep results (Table III) show the #81132 silicone impregnated coils to be the best high-temperature resin tested. Serious damage had been done, as indicated by the darkening and crazing observed (Table II).

The #9555 phenolic cable coils showed an increase in elongation and creep values, indicating the formation of a structure weaker than that of the samples used as control.

Fissuring, crazing, and discoloration were observed, which further substantiates the elongation and creep data. These specimens also flowed under the heat of the Brookhaven pile, as evidenced by the fact that the samples had adhered to the

Table IV—Abrasion Resistance of Insulating Materials

Insulating material	*Treatment*	*Turns to failure (3 kg.)*		
		High	*Average*	*Low*
Phosphoasbestos paper	Control	23	15	5
	ORNL irradiated	17	10	7
	BNL irradiated	22	9	3
	Heat aged	25	14	7
81132 Impregnated 3552 (Silicone impregnated mica tape)	Control	397	198	38
	ORNL irradiated	147	54	10
	BNL irradiated	50	20	2
	Heat aged	335	190	47
3552 (Mica tape)	Control	69	32	12
	ORNL irradiated	25	14	3
	BNL irradiated	17	5	2
	Heat aged	67	31	14

Table V—Stress-Elongation Measurements of Insulating Materials

Insulating material	*Treatment*	*Tensile strength*	*Elongation*	*Elastic modulus*
		p.s.i.	*in./in.*	*p.s.i.*
11523 (Silicone-glass laminate)	Control	9300	0.028	3.6×10^7
	ORNL irradiated	7000	0.023	3.6×10^7
	BNL irradiated	4500	0.016	3.6×10^7
2076 (Phenolic-glass laminate)	Control	38,900	0.036	1.3×10^6
	ORNL irradiated	17,800	0.028	7.7×10^5
	BNL irradiated	14,700	0.024	7.6×10^5

Table VI—Dielectric Strength Measurements of Insulating Materials

Insulating material	*Treatment*	*Breakdown voltage*			*Thickness*	*Dielectric strength*
		Low	*Average*	*High*		
		v.	*v.*	*v.*	*in.*	*v./mil*
Phosphoasbestos paper	Control	780	1090	1460	0.015	73
	ORNL irradiated	960	1080	1280	0.015	72
	BNL irradiated	640	900	1000	0.015	60
	Heat aged	800	1040	1280	0.015	70
81132 Impregnated 3552 (Silicone impregnated mica tape)	Control	2400	4060	6720	0.016	254
	ORNL irradiated	1600	3140	4520	0.016	196
	BNL irradiated	1400	2200	2800	0.016	137
	Heat aged	3600	3970	4320	0.016	248
3552 (Mica tape)	Control	1360	2300	3200	0.016	145
	ORNL irradiated	1360	2260	2760	0.016	141
	BNL irradiated	1000	1530	2200	0.016	96
	Heat aged	2120	2440	2680	0.016	152

Table VII—Mass Spectrometer Analysis of Volatile Degradation Products

Can#[a]	Air	CO_2	CH_4	C_2H_6	H_2O	H_2	*n*-Butane	N_2	Benzene	*n*-Hexane	*n*-Propane
Exposed at Oak Ridge											
1	100%	—	—	—	—	—	—	—	—	—	—
2	100%	—	—	—	—	—	—	—	—	—	—
3	96.3%	1.0%	0.5	0.1	1.6	0.4	—	—	—	—	—
4	—	0.11	21.1	2.52	0.68	14.71	0.4	60.89	—	—	—
5	—	1.50	0.70	0.10	5.1	83.1	—	9.5	0.03	—	—
Exposed at Brookhaven											
1	0.8	Trace	38.3	0.5	0.9	51.3	Trace	8.1	—	Trace	—
2	Trace	39.4	0.6	—	0.9	30.3	Trace	18.0	—	—	Trace
3	—	0.1	18.8	0.9	1.4	54.1	Trace	24.3	0.3	—	—
4	—	0.4	21.8	3.4	1.1	52.9	Trace	20.1	—	Trace	—
5	Sample lost										

[a] Contents of cans:
1. Cable coils impregnated with #81132 silicone resin; #11532 silicone-glass laminate.
2. #3552 mica tape.
3. #3552 mica tape impregnated with #81132 silicone resin.
4. Phosphoasbestos paper impregnated with silicone oil.
5. Cable coils impregnated with Formex and oil-modified phenolic varnishes; #2076 phenolic-glass laminate.

aluminum wrapping foil used to wrap the specimens which were being tested.

The "phosphoasbestos" paper was the most consistently stable material tested, as would be expected from its homogeneous inorganic nature. The induced radio-activity was high enough to indicate the presence of appreciable quantities of impurities such as cobalt, zirconium, and iron, all of which have long half lives.

The #3552 mica tape appears to have undergone a selective decomposition of the organic binder which held the flakes together. This is borne out by the fact that specimens which had been heat-aged (Fig. 2)* showed little change in abrasion resistance from the control. Irradiated specimens decreased in abrasion resistance, indicating that the decrease was due to the embrittlement from irradiation rather than from heating. The mica flakes were not discolored or affected to any noticeable extent.

Abrasion resistance data for the #3552 mica tape impregnated with #81132 silicone resin (Table IV and Fig. 2) clearly show the embrittling influence of radiation compared to that of heat alone.

* Figure 2 appears on p. 158.

Table VIII—Gas Evolution Calculations

Can#[a]	*Free volume*	*Total pressure*	*Volume produced*	*Resin content*	*Gas per g. of resin*
	cu. in.	*atm.*	*cu. in.*	*g.*	*cc./g.*
Exposed at Oak Ridge					
1	7.9	—	—	—	—
2	6.5	—	—	—	—
3	6.5	—	—	—	—
4	6.5	1.64	4.2	1.0	67
5	7.6	10.5	72	21.9	54.1
Exposed at Brookhaven					
1	7.9	12.4	87	23.6	60.7
2	6.5	5.6	13.6	0.1	—
3	6.5	4.0	19.5	1.2	270
4	6.5	5.0	26.0	1.0	420
5	7.6	Sample lost			

[a] See Table VII for contents of cans.

Stress and Strain

Figures 3† and 4† present the changes in the stress-strain curves of the glass laminates. A major portion of the damage to the organic binder has been masked by the strength of the glass laminate itself. In both cases, however, decreases in tensile strength and energy to break are observed. Heat had a more deleterious effect on the silicone laminate than that noted for the phenolic (Table V).

The dielectric strength data (Table VI) also show the serious deleterious effects of the in-pile exposures, particularly when compared to the heat aging data. As expected, the inorganic materials fared better than the organic compositions.

The most significant data in cor-

† Figures 3 and 4 appear on p. 158.

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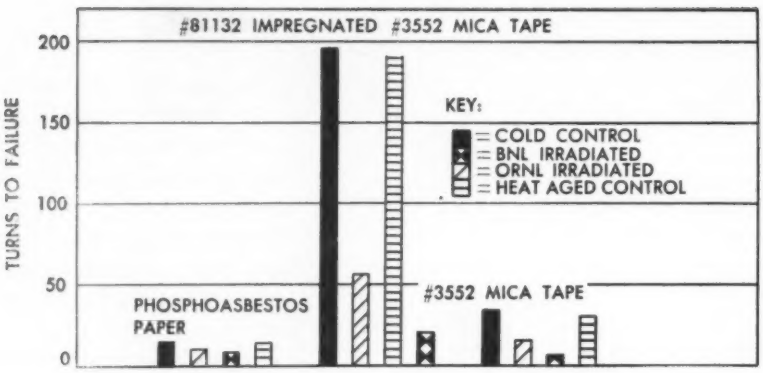

Fig. 2—Abrasion resistances of control and irradiated samples

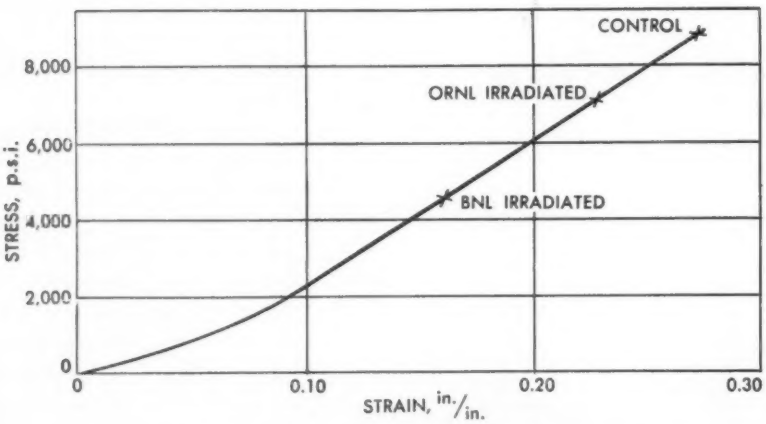

Fig. 3—Effect of radiation on stress-strain curve of G-E #11523 silicone-glass laminate

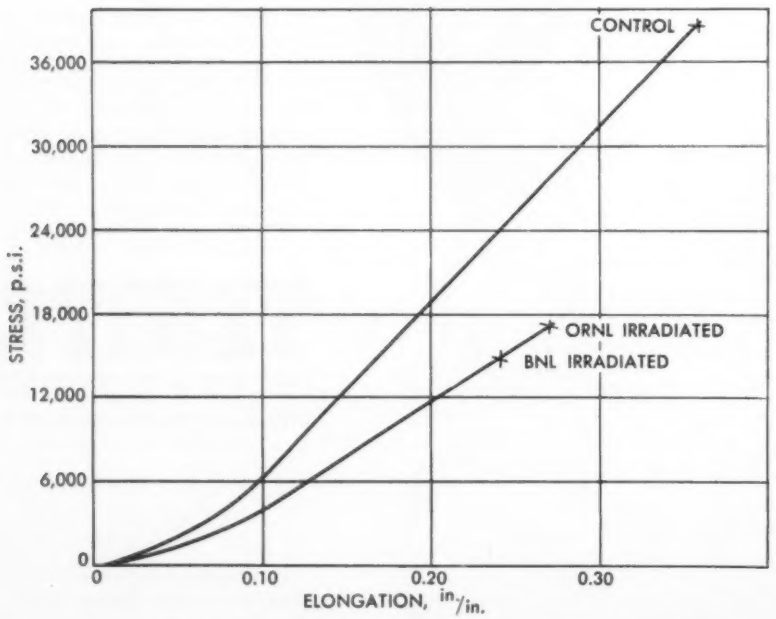

Fig. 4—Effect of radiation on stress-strain curve of G-E #2076 phenolic-glass laminate

relating radiation stability with chemical structure are the gas evolution determinations. The low percentages of benzene and substituted benzene compounds in the gases analyzed indicate that highly phenylated structures are more radiation resistant than non-aromatic materials. The absence of carbon monoxide, ammonia, and unsaturated hydrocarbons in the evolved gases indicates that no compounds having an unshared pair of electrons are possible gaseous products of irradiation (Table VII).

The large quantities of combustible gases formed give a relative idea of the total number of bonds which were broken (Table VIII). For every gas molecule there is approximately one cross-link formed within the resin itself. Taking this into account, it is easy to reconcile the embrittling effects of radiation.

Conclusions

In general, it may be said that the effect of in-pile radiation is to embrittle organic materials. Results of these tests indicate that this is caused as a result of the cross-linkages that are formed upon the recombination of the free radicals which are produced by the radiation. It has also been shown that for use in high level in-pile radiation equipment an aromatic type of insulating material is desirable.

References

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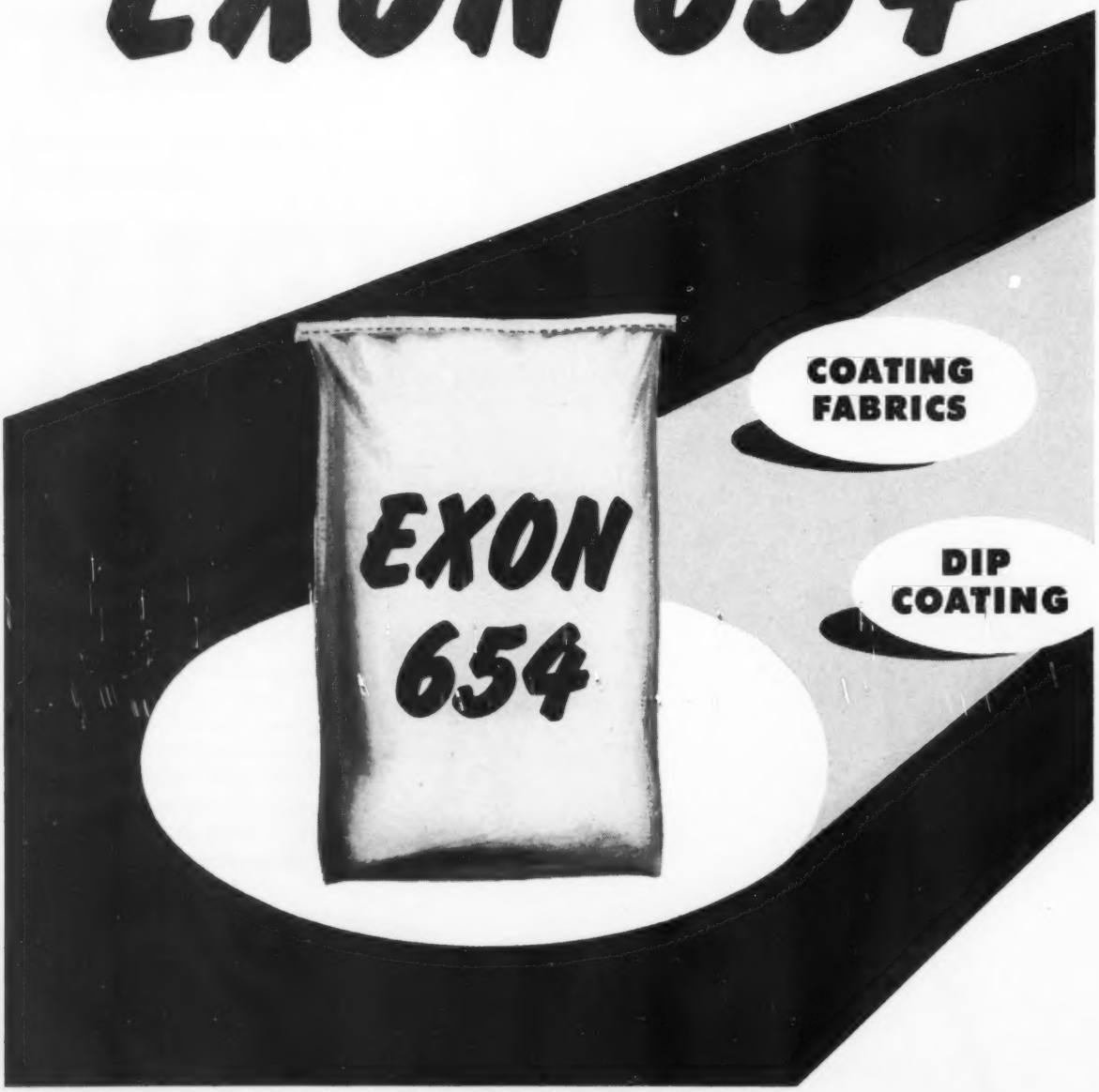

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Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

FIRST CROSS-COUNTRY PLASTIC PIPELINE IN SERVICE. Chem. Eng. *61*, 120 (Jan. 1954). The country's longest all plastic pipeline, nearly 10 miles of 3-in. pipe, is now in service transporting crude oil from a producing field to a loading point. The pipe is made of cellulose acetate butyrate plastic. Installed costs ran 75% of the cost for a comparable size steel line. A crew of three laid the line in only 5 days. The total crew was only six men. Other details are given on how the line was laid, pumping, operating characteristics, and expected maintenance.

RESEARCH PROGRESS IN DIELECTRICS—1953. A. E. Javitz. Elec. Manuf. 53, 88-94 (Jan. 1954). This is a review of the papers presented at the 1953 Annual NRC Conference on Electrical Insulation. The materials considered were Teflon, Kel-F, Mylar film, vinyl insulation, nylon, and other non-metallic insulators. Brief abstracts of the individual papers are included.

PLASTICS. R. B. Seymour. Ind. Eng. Chem. 45. 2237-41 (Oct. 1953). Recent developments in plastics are reviewed. The rate of increase in the use of plastics as materials of construction has even exceeded the phenomenal growth rate of the entire plastics industry. Because of their resistance to both acid and alkaline solutions as well as corrosive salts and many solvents, furan resins continue to be used for tank and floor construction in the chemical industry. Interest in epoxy resins continues, due in part to their good adhesion to a wide variety of surfaces. A large number of hoods and ducts are now being constructed from glass-reinforced polyesters and by the welding of thermoplastic sheets. Pipe for the chemical and petroleum industry is now being extruded from polyethylene, styrene copolymer blends, cellulose acetate butyrate, and polyvinyl chloride. Standards are being established for both thermoplastic structures and pipe. 244 references.

* Reg. U.S. Pat Off.

Materials

EPOXY FATTY ACID ESTER PLASTICIZERS. F. P. Greenspan and R. J. Gall. Ind. Eng. Chem. 45, 2722-26 (Dec. 1953). A series of monohydric and polyhydric alcohol esters of oleic, soybean, and cottonseed fatty acids was epoxidized with peracetic acid. Plasticizer performance was compared with respect to modulus, tensile strength, elongation, hardness, efficiency, low temperature flexibility, permanence, and heat and light stability. Introduction of an epoxy group into the fatty acid chain greatly increased the compatibility of the ester with polyvinyl chloride resins. In general, the epoxy fatty acid esters showed good plasticizing efficiency, equal to or better than dioctyl phthalate. Individual members exhibited excellent low temperature flexibility properties. Permanency was dependent upon structure and molecular weight and varied from fair to excellent. Polyvinyl chlorides formulated with these epoxy fatty acid esters possessed outstanding heat and light stability, even in the absence of added conventional stabilizer. Epoxy fatty acid esters are a new family of plasticizers, based upon abundant and cheap fatty raw materials, showing good general plasticizer performance, combined with a unique inherent stabilizing action for chlorinated polymers.

CHEMIGUM SL—AN ELASTOMERIC POLYESTER-URETHANE. N. V. Seeger, T. G. Mastin, E. E. Fauser, F. S. Farson, A. F. Fineeli, and E. A. Sinclair. Ind. Eng. Chem. 45, 2538-42 (Nov. 1953). Polyester-urethane elastomers are described. Chemigum SL is a condensation polymer prepared by reacting a pre-made polyester of glycols and adipic acid, with diisocyanates. Molecular weights of the raw, storable rubbers are in the range 20,000 to 50,000. The vulcanized gum has a tensile strength of 5450 p.s.i., an elongation of 750%, and an abrasion resistance twice that of the best cold rubber. Chemigum SL is exceedingly tough as measured by its resistance to cutting and gouging. It has already demonstrated its superiority over existing rubbers for tire treads and gives promise of similar results in shoe soles and heels, floor coverings, and industrial rubber products. Because of its superior resistance to abrasion, this new elastomer offers the possibility of using a thinner and cooler running tread on tires designed for high speed service in hot climates. Still another broad new field is seen in use of the polyester as a coating for rubber and plastic articles to protect them against deterioration by oxidation and sunlight.

VINYL CARBAZOLE AND POLYVINYL CARBAZOLE. H. R. Jacobi. Kunststoffe *43*, 381-86 (Oct. 1953). A new use for monovinyl carbazole is the impregnation of condensers, coils, and other electrical parts, with subsequent polymerization. The parts are immersed in special, purified monomer at 70° C. and kept under vacuum until no more air bubbles escape from the immersed parts. Subsequently they are hung in a drying oven and polymerized at 120 to 130° C. These condensers can withstand direct currents up to 1500 v. and alternating currents up to 250 v. for many days after storage at 150° C. They are usable after 450 hr. while oil-impregnated condensers lose their insulating strength after 10 hr. at this temperature. A new polyvinyl carbazole marketed in Germany under the trade name Luvican M170 is a slightly yellow, transparent, amorphous thermoplastic. It can be injection or compression molded and starts to soften only in the vicinity of 200° C. The moldings are resistant to many chemicals and have very good dielectric properties, comparable to those of polystyrene.

POLYTETRAFLUOROETHYLENE — ITS PROPERTIES AND USES. L. W. Cornell. Mech. Eng. 75, 883-86 (Nov. 1953). The electrical, chemical, physical, and mechanical properties of polytetrafluoroethylene (Teflon) are discussed and presented in tabular form. The use of Teflon is increasing because of its excellent properties

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and in spite of its high price. Teflon is now available in many forms including molding powders, suspensoids, films, and tapes. Methods of handling and fabrication of these forms are discussed briefly.

Molding and Fabricating

BLOW-MOLDING OF POLYTHENE BOTTLES. Brit. Plastics *26*, 357-60 (Oct. 1953). Techniques and equipment for the production of blow-molded polythene bottles are described. The method was developed in Britain and is based on the processes used for blowing glassware. The process can be used to produce an infinite range of differently shaped bottles of various capacities and wall thicknesses. The system lends itself to mass-production and two or three different kinds of bottles can be produced at one time. The bottle is blown from a parison, which is a cylindrical tube closed at one end. The parison is injection molded from polythene around a long tube, the nozzle of which is fitted with a valve. While still hot and plastic, the parison with the tube still inside it is transferred to a mold corresponding to the shape of the finished bottle. Air is blown into the parison through the tube and the polythene is forced out against the walls of the mold where it is allowed to cool for a few seconds. The mold is then opened and the finished bottle is removed. The whole cycle can be completed in 30 seconds.

POLYSTYRENE REINFORCED WITH GLASS FIBERS. H. G. Guy. SPE J. *9*, 16-17 (Oct. 1953). The effects of fabrication variables on properties of injection-molded glass-fiber reinforced polystyrene are discussed. The addition of glass fibers to polystyrene increases the stiffness (modulus), tensile, flexural, and impact strengths, as well as the dimensional stability of this resin. The properties of several of these reinforced plastics with various amounts of glass fiber are given.

Applications

ACOUSTICS AND PLASTICS. H. Oberst. Kunststoffe *43*, 446-454 (Nov. 1953). The application of plastics in various aspects of acoustics is surveyed, such as electroacoustics, the technique of shock and vibration damping, room and building acoustics, and noise suppression. The development of plastics with high internal damping properties, materials for non-echoic purposes, is discussed at length. Maximum damping properties of these materials can be obtained by applying knowledge concerning the physics of high polymers.

THIS POLYETHYLENE PIPE BUSINESS. M. H. Branson. Canadian Plastics *1953*, 43-46 (Sept.-Oct.) The polyethylene pipe business in Canada is reviewed in general. It is estimated that 3 million lb. were used in 1953 and that 4.5 million lb. will be used in 1954. Physical and chemical properties enable polyethylene pipe to be used in many industrial plants. Typical uses are cited.

CEMENTS. C. R. Payne. Ind. Eng. Chem. *45*, 2185-88 (Oct. 1953). Recent developments in adhesives are reviewed. New furfuran condensation products have high strength and low shrinkage, and are suitable materials for casting pumps, distributor trays, and similar corrosionproof equipment. Wood impregnated with furan cement has proved to be economical for filter press plates and frames. Polyester cements are finding increased applications in the chemical equipment field; they are used to join the brick linings of equipment handling chlorine dioxide solutions in bleaching paper pulp. When the polyester cement is reinforced with glass fiber, it is used to fabricate tanks, fume ducts, hoods, and pipe. Epoxy cements are used as chemicalproof coverings over concrete floors where trucking is not severe. 66 references.

Properties

STRESS CRAZING OF PLASTICS. J. A. Sauer and C. C. Hsiao. SPE J. *9*, 13-17, 32 (Nov. 1953). The effects of various factors on the inception and growth of crazing are reviewed and some of the similarities between crazing in plastics, exposure-cracking in rubber, and stress-cracking in metals are described. Various examples of stress crazing in transparent plastics are presented and the stress-strain behavior reported for crazed, non-crazed, and oriented material. Rate of propagation of crazing was also investigated. The test results indicate that penetration of crazing cracks in polystyrene can be represented over a limited stress range by a linear function of both time and stress magnitude. Some measures advocated for avoiding the undesirable effects of crazing include use of special coatings, annealing, and establishment of working stresses which are based on onset of crazing rather than those based on static fracture.

STUDY OF DEGRADATION OF POLYSTYRENE, USING ULTRAVIOLET SPECTROPHOTOMETRY. M. J. Reiney, M. Tryon, and B. G. Achhammer. J. Research Nat. Bur. Standards *51*, 155-65 (Sept. 1953). The role of ultraviolet radiant energy and the effect of presence of monomer on degradation of polystyrene were studied by means of ultraviolet absorption techniques. Exposure of pure polystyrene to ultraviolet radiant energy resulted in increased absorption in the ultraviolet region of 280 to 400 millimicrons, which advanced progressively as exposure time increased. The presence of monomer increased the rate of degradation without altering the general type of absorption. A post-radiation effect was noted in both the purified polymer and polymer containing monomer styrene. Again, the presence of monomer increased the rate of progress of the post-radiation effect. Possible mechanisms are postulated for the ultraviolet degradation, and the concept of entrapped free radicals is considered as a possible explanation for the post-radiation effect observed.

STRUCTURE AND MOISTURE PERMEABILITY OF FILM-FORMING POLYMERS. P. W. Morgan. Ind. Eng. Chem. *45*, 2296-2306 (Oct. 1953). The moisture permeabilities of over 100 polymers in film form were determined at 39.5° C. and a vapor pressure differential equivalent to 53 mm. of mercury. Of these materials only 20 had permeabilities below 50 g. of water vapor per 100 m.^{2} per hour at a thickness of 0.002 inch. The film-forming materials having low permeabilities were polyethylene, rubber hydrochloride, vinylidene chloride copolymers, polytetrafluoroethylene, polychlorotrifluoroethylene, and isobutylene-isoprene copolymers. It is concluded that in order to obtain films having very low moisture permeabilities, the film-forming polymers should have the following structural characteristics: 1) a saturated or nearly satu-

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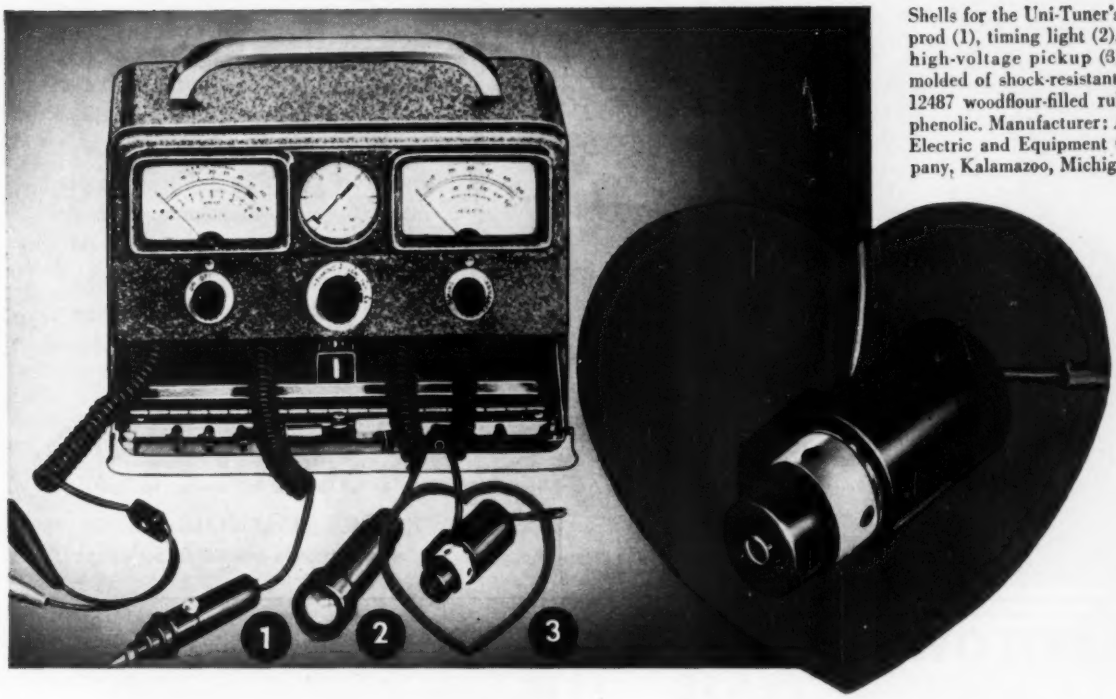

Shells for the Uni-Tuner's test prod (1), timing light (2), and high-voltage pickup (3) are molded of shock-resistant G-E 12487 woodflour-filled rubber-phenolic. Manufacturer: Allen Electric and Equipment Company, Kalamazoo, Michigan.

The "heart" of Allen Electric and Equipment Company's Uni-Tuner is the high-voltage pickup. Its shell must have good electrical properties and adhere firmly to the telescoping insert. In manufacturing, the shell is machined away to allow electrical contact with the insert.

Many plastics materials were evaluated, but only General Electric rubber-phenolics were resilient enough to take this machining without shattering. In addition, this tough plastics provided the high impact strength required for constant contact with engine parts. Another new design made possible—by shock-resistant G-E rubber-phenolics!

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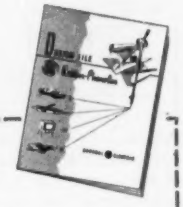

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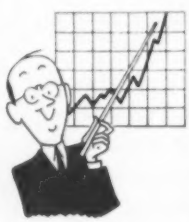

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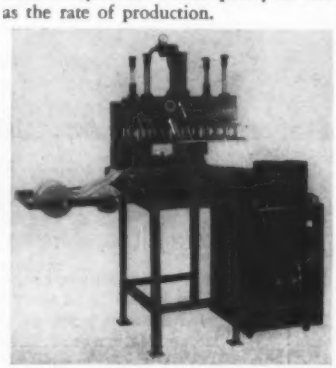

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EFFECT OF CERTAIN FABRICATING VARIABLES ON PLASTIC LAMINATES AND PLASTIC HONEYCOMB SANDWICH CONSTRUCTION. B. G. Heebink, F. Werren, and A. A. Mohaupt. Forest Products Laboratory Report No. 1843 (Nov. 1953). Investigations with four typical low-pressure laminating resins show that variations in fabrication pressure have varying effects on the physical and strength properties of the laminates. In most cases, however, optimum mechanical properties were obtained with pressures in the range of 15 to 30 p.s.i. Tests on sandwich constructions show that the sandwiches made with premolded facings have higher edgewise compressive strength and lower tensile strength (normal to the facings) than sandwiches having entirely "wet-laminated" facings. Compressive strength values are about the same when premolded facings with one, two, or three wet-laminated plies are used, but drop substantially when the facings are entirely wet laminated. The bond between the facings and the core, as judged by tensile tests normal to the facings, increases in strength with an increase in the number of wet-laminated plies used to form the bond. Information useful in determining the minimum cure cycles for various resins can be obtained from a hot press after various times at certain test temperatures.

DETERMINATION OF ELASTIC CONSTANTS OF ORTHOTROPIC MATERIALS WITH SPECIAL REFERENCE TO LAMINATES. R. K. Witt, W. H. Hoppmenn, and R. S. Buxbaum. ASTM Bulletin No. 194, 53-57 (Dec. 1953). The theoretical basis and an experimental method for determining the anisotropic elastic constants of a material by measuring deflections of a thin plate of the material subject to couples on its boundary are described. Using the method, elastic constants are determined for three different laminates.

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OF A HIGH POLYMER FROM GLASS IN A VACUUM. V. V. Karasev, N. A. Krotova, and B. V. Deryagin. Translated from Doklady Akademii Nauk SSSR *88*, 777 (1953). U. S. National Science Foundation, NSF-tr-28. It is shown that electrons are emitted from films of polymer when they are stripped from glass. These electrons bombard the glass and cause it to fluoresce. The energy of these electrons was found to range between 10^3 to 10^4 electronvolts. Benzyl cellulose, cellulose acetate, and natural rubber were the materials used in the experiments.

Testing

MECHANICAL TESTING AND INSPECTION OF STRUCTURAL ADHESIVES. H. Grinsfelder, B. Coe, and R. P. Hopkins. ASTM Bulletin No. 194, 62-66 (Dec. 1953). The influence of several factors that may affect the behavior of adhesives in a few of the more common mechanical tests is discussed. The application of statistical methods to adhesive testing, especially as a means of reducing the required number of destructive tests for structural adhesives, is described with examples. It is pointed out that deteriorating effects of adhesives on the mechanical properties of the adherends is an important factor concerning which little is known.

Chemistry

CURE OF PHENOL-FORMALDEHYDE RESIN. PROGRESS DETERMINED BY ULTRASONIC WAVE PROPAGATION. G. A. Sofer, A. G. H. Dietz, and E. A. Hauser. Ind. Eng. Chem. 45, 2743-48 (Dec. 1953). The strong dependence of ultrasonic propagation parameters on the extent of cure of phenolic molding resins suggests that they may be used as criteria for the extent of polymerization of phenolic and other thermosetting molding resins. Measurement of these parameters can be made while the resin is undergoing cure in a typical compression mold, thus providing instantaneous information regarding the progress of cure. The technique also seems capable of providing useful indication of the rate of cure. This method, however, will not furnish absolute information relative to the extent or rate of reaction, but may be calibrated against any technique that might yield such information.

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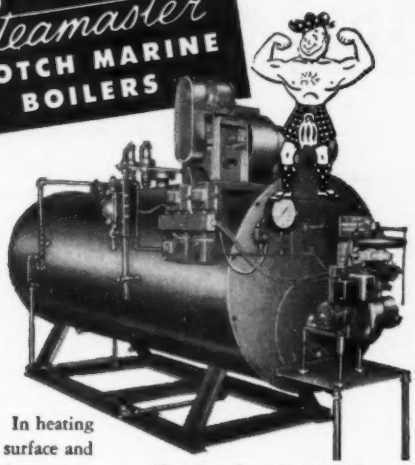

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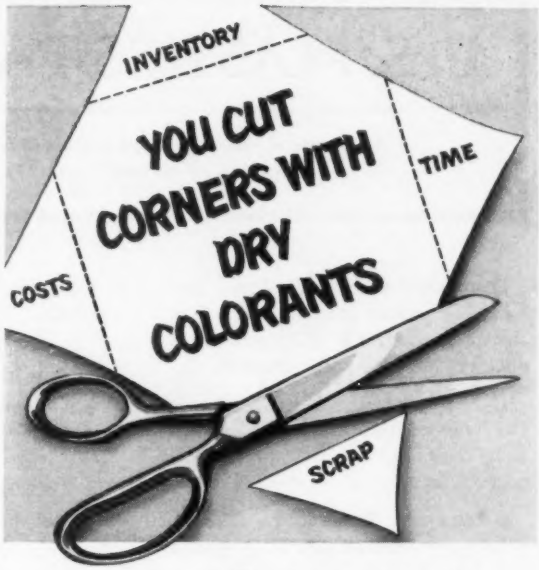

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

POLYURETHANES. W. D. Jones and S. B. McFarlane (to Celanese). U.S. 2,660,574, Nov. 24. Polymers of a diamine and bis-chloroformate.

R-F HEATING. T. Von Hauteville (to International Standard Electric). U.S. 2,660,660, Nov. 24. Radio-frequency heating of thermoplastics.

CELLULOSE TREATMENT. K. E. Folkers (to Monsanto). U. S. 2,661,-262, Dec. 1. Colloidal methyl ether of methylolmelamine for textile treatment.

COATING. N. C. Foster (to Westinghouse). U.S. 2,661,307, Dec. 1. Applying polymerizable resin to electrical elements.

COATED PAPER. J. L. Azorlosa (to Hercules). U.S. 2,661,309, Dec. 1. Paper coated with acrylic copolymers.

TEXTILE TREATMENT. K. E. Folkers (to Monsanto). U.S. 2,661,313, Dec. 1. Shrinkproofing textiles with colloidal methylolmelamine-formaldehyde ethers.

POLYMERIZATION. E. G. Howard, Jr. (to Du Pont). U.S. 2,661,331, Dec. 1. Photopolymerization in the presence of a polyvalent metal ion.

RESIN. H. K. Nason, M. L. Nielsen, and J. E. Malowan (to Monsanto). U.S. 2,661,341-2, Dec. 1. Fire-resistant phenolic resin composition containing phosphorus oxychloride.

ACRYLONITRILE. R. J. Slocombe and G. L. Wesp (to Monsanto). U.S. 2,661,343-4-5-6-7, Dec. 1. Stabilized acrylonitrile polymers.

RESINS. C. E. Welsh and N. G. Holdstock (to General Electric). U.S. 2,661,348, Dec. 1. Preparation of polysiloxane resins.

EXTRUSION. J. N. Birmingham (to Celanese). U. S. 2,661,497, Dec. 8. Extrusion apparatus.

MOLDING. E. E. Blaurock (to U. S. Rubber). U. S. 2,661,498, Dec. 8. Molding metal parts into plastic articles.

CONTAINERS. C. E. Slaughter (to Extruded Plastics). U. S. 2,661,790, Dec. 8. Machine for making tubular containers.

PIPE CONNECTOR. L. R. Nelson. U. S. 2,661,962, Dec. 8. Connector for plastic pipe.

PACKAGE. J. A. Okie (to Crystal X). U. S. 2,661,981, Dec. 8. Permeable polyethylene bag for insecticides.

COATED FABRICS. A. R. Morrison and R. F. Shannon (to Owens-Corning Fiberglas). U. S. 2,662,044, Dec. 8. Thin web of glass fibers with thermoplastic coating.

WALL SURFACING. G. H. Mead (to Minnesota Mining). U. S. 2,662,064, Dec. 8. Wall surfacing composition containing resins.

POLYFLUOROETHYLENES. K. L. Berry (to Du Pont). U. S. 2,662,065, Dec. 8. Dispersions of polyfluoroethylenes.

ADHESIVES. L. E. Clark, Jr. and C. F. MacLagan (to Borden). U. S. 2,662,066, Dec. 8. Urea-aldehyde adhesive.

MOLD. F. W. Less, E. C. Roeck, and J. C. Searer (to Durez). U. S. 2,662,-067, Dec. 8. Shell mold composition.

GELS. D. E. Floyd (to General Mills). U. S. 2,662,068, Dec. 8. Polyamide gelling agent for organic solvents.

RESINS. P. Kass (to Atlas). U. S. 2,662,069-70, Dec. 8. Linear polyester resins and copolymers thereof.

RESINS. E. Elod. U. S. 2,662,071, Dec. 8. Dicyandiamide-urea-formaldehyde impregnating agents.

COPOLYMERS. W. T. Miller (to U. S.). U. S. 2,662,072, Dec. 8. Copolymerizing tetrafluoroethylene with monochlorotrifluoroethylene.

EXTRUSION. C. F. Schnuck and W. C. Whittum (to Farrel-Birmingham). U. S. 2,662,243, Dec. 15. Blending and warming extrusion device.

MOLDING. R. S. Ames (to Goodyear Aircraft). U. S. 2,662,248, Dec. 15. Forming molds for casting thermosetting transparent enclosures.

FASTENER. J. Loewengart. U. S. 2,662,308, Dec. 15. Plastic article with integral fastening means.

RESINS. W. W. Crouch (to Phillips Petroleum). U. S. 2,662,862, Dec. 15. Drying resins from oil-modified alkyds and liquid polybutadiene.

POLYMERIZATION. J. E. Bristol, W. A. Harrington, and N. Turnbull (to Du Pont). U. S. 2,662,863, Dec. 15. Emulsion polymerization of vinyl acetate.

COATING. D. N. Beauchamp (to Sherwin-Williams). U. S. 2,662,865, Dec. 15. Coating containing phenolic resin and a polyamide.

POLYMERIZATION. J. E. Bristol and N. Turnbull (to Du Pont). U. S. 2,662,866, Dec. 15. Emulsion polymerization of vinyl acetate.

STABILIZERS. J. B. Hoertz (to B. F. Goodrich). U. S. 2,662,867, Dec. 15. Stabilizing haloethylene polymers.

RESINS. F. Kaess and E. Doehlmann (to Sueddeutsche Kalkstickstoff-Werke). U. S. 2,662,868, Dec. 15. Dicyanodiamide resins.

ADHESIVE. H. S. Bloch (to Universal Oil). U. S. 2,662,869, Dec. 15. Vulcanized composition from sulfur, rubber, and an alkenyl phenol.

RESINS. O. C. W. Allenby (to Canadian Industries). U. S. 2,662,870, Dec. 15. Reaction products of polyepoxides with styrene acrylic acid vinyl pyridine copolymers.

POLYESTERS. L. H. Bock (to Rayonier). U. S. 2,662,871, Dec. 15. Polyesters from dibasic acids derived from vanillin.

RESINS. D. M. Gagarine, W. B. Smith, Jr., and M. T. Spangler (to Dan River Mills). U. S. 2,662,872, Dec. 15. Modified methylol melamines.

RESINS. F. Kaess, E. Doehlmann, and E. Vogel (to Sueddeutsche Kalkstickstoff-Werke). U. S. 2,662,-873, Dec. 15. Melamine-amino carbinol condensates.

RESINS. D. W. Chaney (to Chemstrand). U. S. 2,662,875, Dec. 15. Ter-

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POLYMERIZATION. H. W. Bryant (to Du Pont). U. S. 2,662,878, Dec. 15. Polymerization control of vinyl acetate.

SILOXANES. L. H. Sommer (to Dow Corning). U. S. 2,662,909-10, Dec. 15. Aminosiloxanes and ketosiloxanes.

RESINS. W. B. Winkler. U. S. 2,663,649, Dec. 22. Ester modified polyamide resins.

COATING. W. E. Railing (to Du Pont). U. S. 2,663,652, Dec. 22. Process for coating with polyethylene.

NAILABLE MATERIAL. C. B. Hess and H. M. Richardson (to Brasco Manufacturing). U. S. 2,663,693, Dec. 22. Nailable composition containing a rubber, plasticizer, cellulose, and asbestos.

COATING. R. L. Miller (to Glidden). U. S. 2,663,694, Dec. 22. Alkyd-modified siloxane coating compositions.

FILLER. J. W. Perloff and L. Jacobson (to Diamond Alkali). U. S. 2,663,695, Dec. 22. Calcium carbonate particles coated with chlorinated paraffin wax as filler for vinyl resins.

PRINTING EMULSIONS. E. F. Armatys (to Sun Chemical). U. S. 2,663,696, Dec. 22. Textile printing emulsions containing thermoplastic and thermosetting resins.

POLYMERS. H. W. Coover, Jr., J. B. Dickey, and N. H. Shearer (to Eastman Kodak). U. S. 2,663,697, Dec. 22. Polymers of 3-methylenephthalide.

TANNINS. E. D. Compton (to Monsanto). U. S. 2,663,698, Dec. 22. Sulfonated phenolic novolaks.

NOVOLAKS. H. Bloem and M. Stel (to Hartford National Bank). U. S. 2,663,699, Dec. 22. Continuous production of novolaks.

RESINS. H. H. Roth and H. B. Smith (to Dow). U. S. 2,663,700, Dec. 22. Purification of sulfonated alkenyl aromatic resins.

POLYMERIZING. G. S. Ronay and J. R. Vinograd (to Shell). U. S. 2,-

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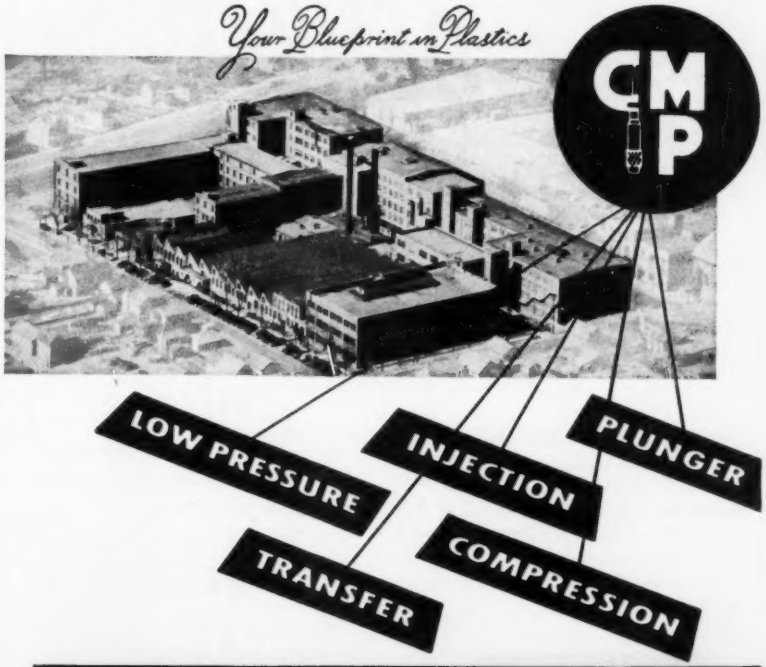

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663,701, Dec. 22. Polymerization in aqueous systems.

POLYMERS. E. L. Kropa (to American Cyanamid). U. S. 2,663,702, Dec. 22. Quaternarizing polymers of N,N-dimethyl-*p*-amino styrene.

HELMET. G. A. Lyon. U. S. 2,663,874, Dec. 29. Plastic helmet.

THERMOPLASTICS. C. E. Slaughter (to Extruded Plastics). U. S. 2,663,904, Dec. 29. Extrusion of thermoplastics.

PLASTIC STRUCTURE. E. L. Danielson and F. J. Dofsen (to E. L. Danielson). U. S. 2,663,910, Dec. 29. Casting a multipart plastic structure.

DECORATING. H. O. Waag and S. R. Prance (to General Motors). U. S. 2,663,911, Dec. 29. Decorating a plastic steering wheel.

LIGNIN. W. G. Van Beckum and A. K. Esterer (to Weyerhaeuser). U. S. 2,664,377, Dec. 29. Impregnating and laminating with lignin.

POLYETHYLENE. G. W. Heller (to Du Pont). U. S. 2,664,378. Dec. 29. Forming articles from polyethylene film.

ION EXCHANGE. W. M. Hutchinson (to Phillips Petroleum). U. S. 2,664,397, Dec. 29. Carboxyalkyl cellulose ether ion exchange resins.

TILE. M. C. Armstrong (to Owens-Corning). U. S. 2,664,406, Dec. 29. Tile composed of glass fibers, gypsum cement, and amine-aldehyde resin.

RESIN COMPOSITION. R. E. Plump and J. W. Carroll (to Pennsylvania Salt). U. S. 2,664,408, Dec. 29. Urea-aldehyde-sulfite waste liquor condensate.

PLASTICIZERS. J. R. Darby and L. E. Wells, Jr. (to Monsanto). U. S. 2,664,410, Dec. 29. Plasticized halogen-containing resins.

RESINS. R. S. Cooper (to Diamond Alkali). U. S. 2,664,411, Dec. 29. Compositions of a resin, chlorinated paraffin wax, and triphenyl stibine.

COPOLYMERS. G. E. Ham and A. B. Craig (to Chemstrand). U. S. 2,664,412, Dec. 29. Copolymers of acrylonitrile and nicotinamides.

COPOLYMERS. E. E. Parker (to Pittsburgh Plate Glass). U. S. 2,664,413, Dec. 29. Preventing premature polymerization of copolymerizable mixtures.

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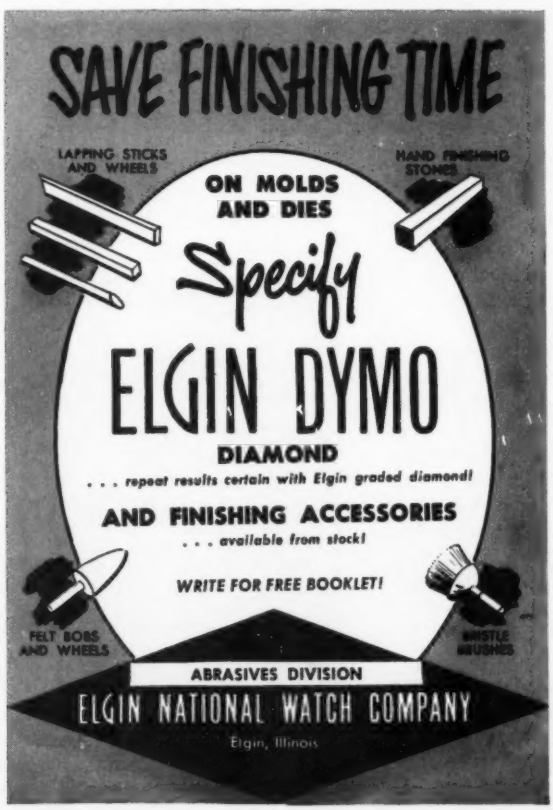

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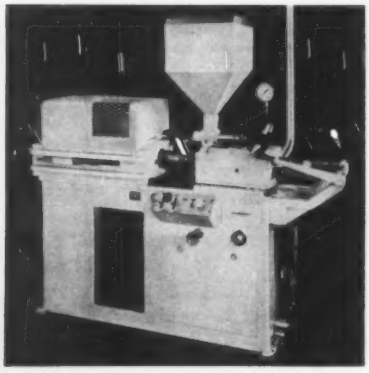
NEW MACHINERY AND EQUIPMENT

Grinder—Electric stone mill for grinding fibrous organic materials, adjustable to nine degrees of fineness, has been produced by Lee Engineering Co., 2023 W. Wisconsin Ave., Milwaukee 3, Wis.

Material is fed into the grinding chamber of the ½-hp. unit in amounts regulated by an automatic governor, and is ground to a uniform mesh by being centrifugally forced against a stationary abrasive ring. Ventilation of the grinding chamber prevents the development of heat which might affect the material being ground. Capacity depends on material. When grinding wheat into flour, for example, capacity is 8 to 10 lb./hr.; coarse particle sizes are ground in a much shorter period of time.

Injection Machine—A fully automatic, 1½-oz. injection molding machine, called Automolder and originally developed in Australia, has been made available to United States manufacturers by Standard Tool Co., Leominster, Mass., as a result of a partnership agreement between that company and Pierwood Plastics Ltd. of Australia, holders of the patents on the machine. A number of machines, built according to the original design, are reported to have been tested in actual production work in this country over the past two years, and various improvements added during that period.



Standard Tool's 1½-oz. fully automatic injection molding machine is of the straight hydraulic type

The model being offered now is of the straight hydraulic type, requiring no adjustments for varying mold heights and providing positive clamp. The 20-ton clamp is said to be capable of holding up to 25 sq. in. molding area. There are no electrical timers, injection and clamp being controlled by adjustable cams. Overall cycle is controlled by a Verispeed transmission directly connected to the cam shaft. Special attachments serve to assure full ejection of the complete shot and to cut any strings that might tend to hold the shot from completely releasing itself. A balance trap mounted under the mold opening serves to provide mold protection against the press closing on unejected parts by shutting off the machine and heat until all parts have been removed.

A 125-lb. hopper is mounted over a metering device which feeds the granulated material into a water-cooled plunger chamber. The material cylinder is of conventional design. Its front zone is heated by an 1800-w. band and its rear zone by a 600-w. band; a 150-w. band is on the nozzle. Front and rear zones are controlled by wall-mounted, West Gardsman proportioning type instruments. With a minimum mold thickness of 6 in., a 6¾-in. stroke can be obtained.

The machine is said to be capable of operating at 1200 cycles per hr. and is reported to have molded 30 lb. of plastic per hr. under constant operation. According to the maker of the machines, one operator is able to completely maintain and control the automatic operation of 12 units.

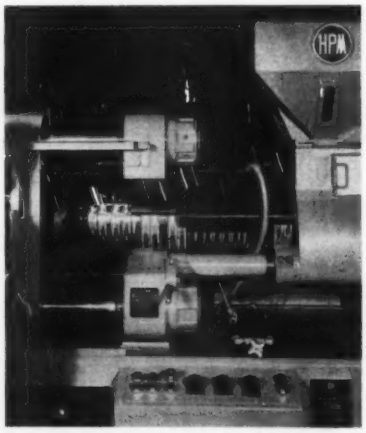
Printing Press—Designed for the screen process printing and decorating of rigid plastics and metal sheet, a decorator press can handle sheet sizes from 8 by 12 in. to 19 by 25 in. in area and 0.010 to ⅝ in. thick. The press is manufactured by General Research & Supply Co., 572 S. Division Ave., Grand Rapids 3, Mich.

Speed range is from 1000 to 2000 sheets per hour. The press can be fed either manually from an automatic stock lift or automatically by a conveyor system. Printed sheet is delivered by tapes for the drying operation. Register can be adjusted while press is running.

Saw—Long-railed panel saw, designed to cut acrylic and reinforced plastics up to 10 ft. long, produces bevel or miter cuts from 0 to 90°. It is being offered by Hendrick Mfg. Corp., Marblehead, Mass.

In operation, sheets of stock are held in a firm position and the saw is drawn through them, carrying the cuttings downward. The saw, riding on rails, is advanced by turning a handwheel clockwise on the frame. The manufacturer states that cutting rates of up to 75 ft./min. are possible, with saw carriage returning to starting position in 5 seconds. For repetitive production cutting, variable speed drives may be belted directly to the handwheel drum shaft.

Heating Chamber—Now standard on all its 9-, 16-, 32-, and 60-oz. injection molding machines, a new heating chamber, developed by The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, is said to lower heat requirements approximately 100° F., and reduce injection pressure on the material by up to 3000 p.s.i. In-



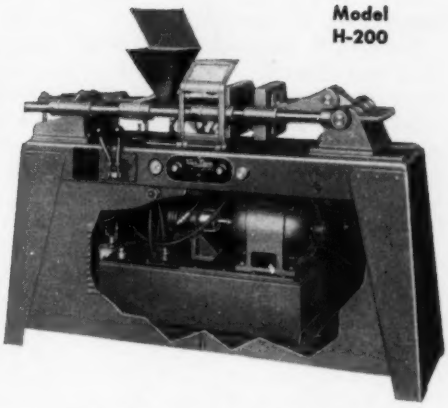
H-P-M's new heating chamber has three-zone heat control, with heater concentration at entrance of chamber

Model H-200

SEMI-AUTOMATIC INJECTION PRESS

2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

Model H-200



Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

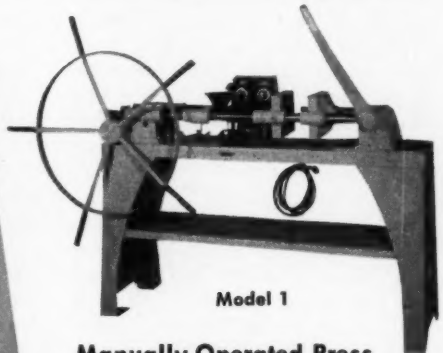
VAN DORN
Plastic Equipment

COSTS LESS to Buy...to Operate!

Van Dorn presses are *unexcelled in efficiency* and *unequalled in economy* on the innumerable jobs where a 2-oz. injection is ample. Costwise, Van Dorn presses are outstanding for these reasons:

1. **Surprisingly low in price**
2. **Operate 8 hours for a few dollars**
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*

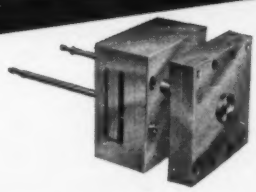


Model 1

Manually Operated Press
1-oz. capacity. Ideal for smaller jobs, experimental work, training.

Plastic Grinder
Grinds up rejects, waste, etc., for re-use. Ruggedly made, easily cleaned.

Model G-100



Mold Bases
. . . Available from stock for all Van Dorn presses.

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creased plasticizing capacity and faster cycles are also claimed.

The unit is designed with three-zone heat control, with concentration of high-wattage heaters at the entrance of the chamber. Heat is applied directly to the spreader to prevent air gaps and consequent heat loss. The chamber is easily dismantled for cleaning.

Engraver—No longer than a typewriter, a new machine engraves panels, dials, name plates, signs, and similar items. Designated Model I-L, the machine was designed by New Hermes Engraving Machine Corp., 13 University Pl., New York 3, N. Y.

Adjustable copy holding slides allow an operator to engrave a name plate with several lines to any spacing desired. A pantograph arrangement permits ratio changes by sliding operations without disassembly. Fifteen sizes may be engraved from one master letter. An automatic depth regulator with micrometer attachment is designed to assure uniform depth of cut on uneven or curved surfaces.

Injection Machine—Model HA2-65 2-oz. automatic injection molding machine engineered by Improved Machinery Inc., Nashua, N. H., has a 15-in. die stroke and 30-in. daylight. Stroke is adjustable down to 3 inches. Designed with a 65-ton full hydraulic clamp, the unit is reported to inject 2 oz. of polyethylene or 3 oz. of styrene at an estimated rate of approximately 60 lb. per hour. It is equipped with a 43-gal./min. 1000 p.s.i. pump, and a 20-hp. motor. All hydraulic equipment is outside the machine base. Control panel with timers, pyrometers, and other controls can be mounted on either wall or stand.

The machine can be operated fully automatically, semi-automatically, or manually, and has low-pressure closing for mold protection, with timed shut-down and signal in cases of improper ejection. A large, free area under platens and mold can be used for take-off conveyor, incline hammock, or submersion tank.

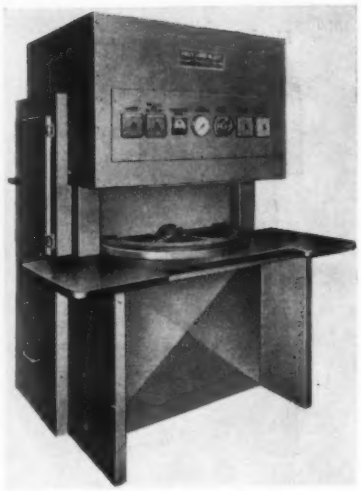
On a 15-in. clamp stroke, the machine is said to dry-run at approximately 700 cycles per hr., and at 840 cycles per hr. on a 5-in. stroke.

Heater—A line of electric heaters for use on 5-gal. drums has been produced by Pre-Fab Heater Co., Guilford, Conn. Constructed of electrically insulated alloy resistance wire and an outer braid for wear resistance, the heaters wrap around drums and are held in place with snap fasteners. A blanket of fibrous glass can be used to surround the heater and drum for increased heat-up speed.

According to the manufacturer, the heaters are especially suited for heating substances which might be damaged by excessive temperatures. Heat is applied uniformly at every point around the drum sides and can be, if necessary, held at a level which will not exceed the melting point of the material in the drum.

Wet Blasting—Automatic finishing by means of wet-blasting operations is accomplished by the Pressure Blast Roto-Matic, introduced by The Cro-Plate Co., Inc., 747 Windsor St., Hartford, Conn.

The machine consists essentially of a rotating work table, three finishing chambers, and controls. When in use, an operator sits in front of the unit and loads and unloads work pieces from the rotating table, which is equipped with work holding fixtures. The table rotates through the three chambers: the blast chamber, where fixed position guns finish the work; the rinse chamber, where abrasive slurry is removed from the work; and the air chamber, where work pieces are dried. All controls are mounted on one panel, including a variable-speed table drive regulator which governs the exact amount of time the work is to be blasted.



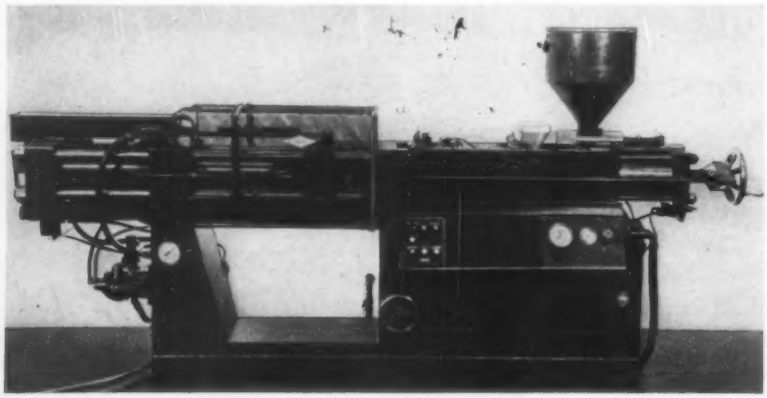
Cro-Plate's wet blasting machine is designed for the automatic finishing of a variety of plastics pieces

Mill—Model 52TF floating three-roll mill, with two-point hydraulic adjustment and pressure recording gages, is produced by Charles Ross & Son Co., 148 Classon Ave., Brooklyn 5, N. Y.

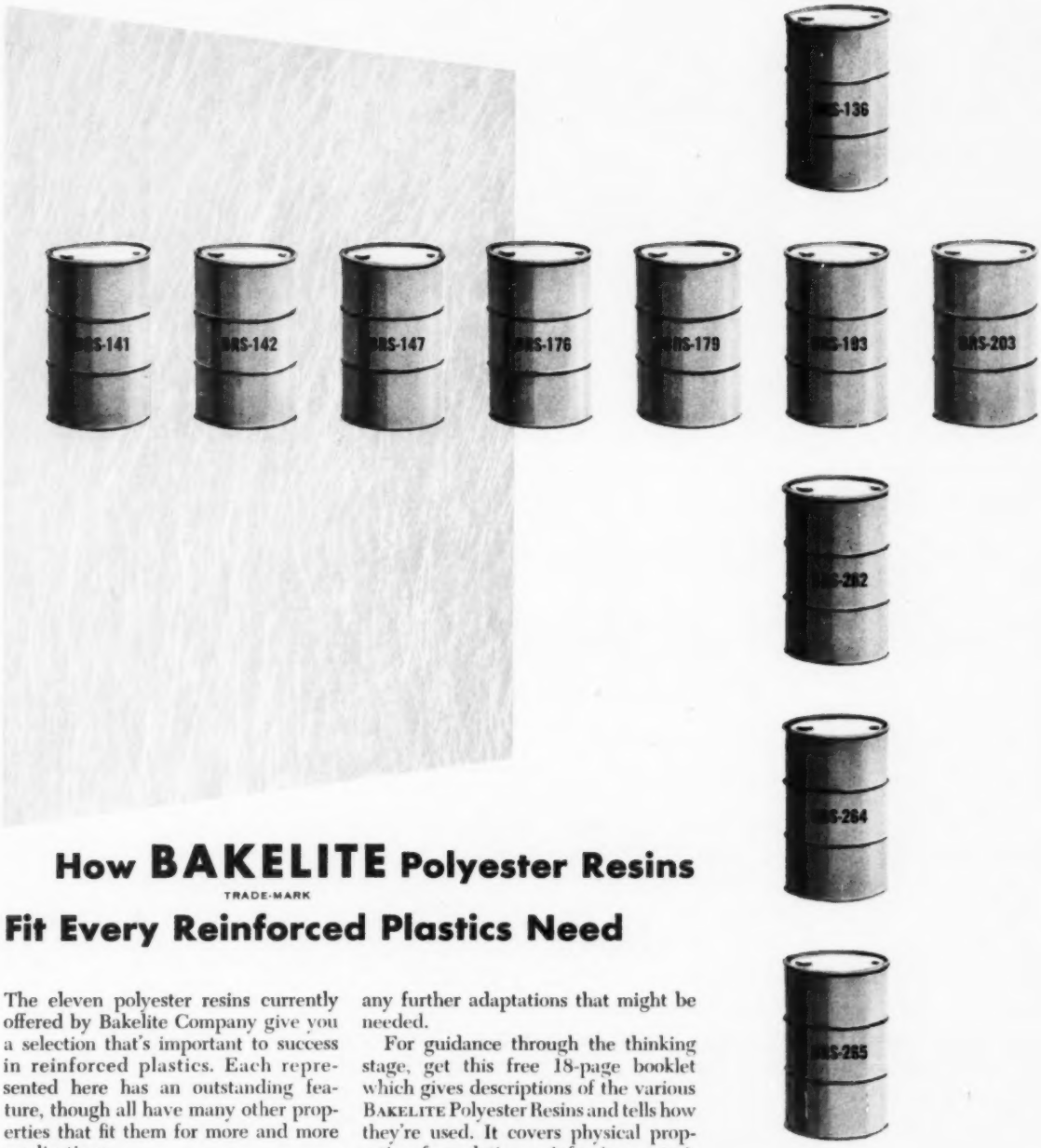
To set the mill to any required roll pressure reading, handwheels, located at the front of the unit, are turned until gages indicate the desired pressure. These gages are an integral part of the hydraulic roll adjustment, and there are no mechanical adjustments that might cause wear on the gages or result in loss of gage efficiency. As the handwheels are turned, the back roll is moved hydraulically; the front roll is fixed, and the middle roll locates itself parallel to front and back rolls.

For cleaning the mill, the hand-

(*Continued on p.* 183)



Impco's Model HA2-65 injection machine has 15-in. die stroke and 30-in. open daylight



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- **Adaptability to fabrication into large sections with simple tools and equipment**
- **Economy through low-cost tooling and long service life.**

However, with this wide variety of BAKELITE Polyester Resins to choose from, you can come closer to the one that meets the requirements of your job exactly. In addition, Bakelite Company engineers are available to help with any further adaptations that might be needed.

For guidance through the thinking stage, get this free 18-page booklet which gives descriptions of the various BAKELITE Polyester Resins and tells how they're used. It covers physical properties, formulation, reinforcing materials, compounding, production methods, and fabrication. A technical bulletin is also available on each resin. Write Dept. UJ-13.

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A NEW, TRULY GENERAL-PURPOSE

BMG-5000 Black 25 is a "universal" molding material offering these outstanding advantages:

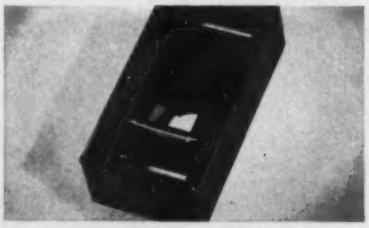
• Unsurpassed uniformity • Better balance between cure speed and molding latitude • Suitable for compression, transfer, and plunger molding • Excellent dimensional stability and machinability • Low specific gravity • High gloss

BAKELITE Phenolic BMG-5000 Black 25 has more molding latitude and serviceability than any other general-purpose phenolic—a truly "universal" molding material. Produced by Bakelite Company on specially-engineered, automatic, semicontinuous equipment, it provides uniformity never before attained in this class of materials.

Laboratory and field tests both show that BMG-5000 molds well over a wide range of preheating and molding conditions. It has better balance between molding latitude and cure speed than earlier phenolic compounds. It does not precure as rapidly. It allows preheating at higher temperatures for longer periods of time.

With BMG-5000, you can minimize problems caused by variations in time, pressure, and temperature in press operations. It fills out the mold at lower pressures than are needed

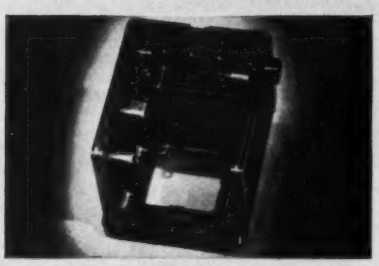
Fast cure of a relatively thick section is shown by this washing machine lock roller. BMG-5000 reduced curing time to 1 minute, 10 seconds, giving a saving of 22% and substantially increasing output.



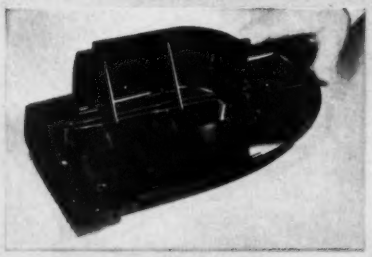
Critical dimensions of this camera case were maintained despite thick and thin sections, undercuts, and welding problems. Finished piece shows no gas marks or weld lines, meets all dimensional specifications.

BMG-5000

PHENOLIC MOLDING MATERIAL



Reflex camera case molded from BMG-5000 has intricate design to fit mechanism. Various dimensions had to be kept to close tolerances to prevent light leakage. New molding material cut cure time 28% over former material used.



This juke box part is an example of off-balance design requiring uniformly thin sections (3/32 in. thick) coupled with a deep die filling problem — it is 4 inches deep. The excellent hot rigidity of BMG-5000 eliminated sticking and swelling, and the piece was ejected from the cavity without any retarding effect.

for comparable general-purpose materials, and flows more rapidly into mold cavities, providing maximum closing speeds.

You can use this new material for compression, transfer, and plunger molding. Parts molded from it have uniformly high gloss, rich black color. Its dimensional stability is excellent during and after molding. Overall machinability is better than that of other general-purpose phenolics, as are the physical, electrical and chemical properties.

The specific gravity of BMG-5000 is 1.33 to 1.35. This means substantial savings in production costs. You also save by cutting down on materials inventory.

Learn more now about the properties and characteristics of BMG-5000. Write today to Dept. UL-13 for Bakelite Molding News, No. 1.

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FACT: *"Speed"* and *"Efficiency"* are not hollow phrases at WMP. This typical WMP conveyorized production line is busily engaged in degating, spraying, buffing, inspecting and packing portable radio cases.

FACT: Your interest—and ultimately, the quality of your product—is protected by WMP's policy of paying factory employees an hourly wage. There are no pieceworkers in our plant . . . your guarantee of superior workmanship.

FACT: A glance at WMP's sample showcase reveals a preponderance of high-grade plastics applications moulded for leading American companies. It is *basic* products such as these, moulded for reputable manufacturers, to which we devote all our production skills.

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Custom Injection Moulders

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14 HYGEIA STREET, WORCESTER 8, MASS.

wheels are turned until gages record zero pressure and the rolls are separated by high-compression springs. For pre-mixing between back and middle roll, the front roll can be disengaged; when premix is completed, the front roll is released and the middle roll adjusts to front roll for finish grind and take-off.

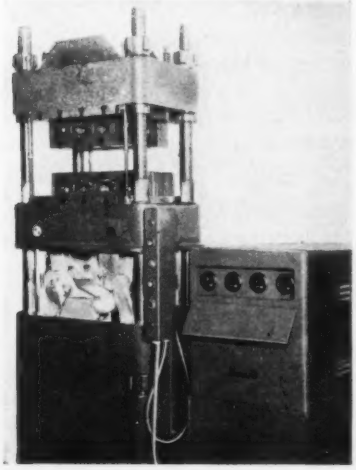
An apron, designed so that constant pressure is maintained on the front roll as the take-off knife wears, prevents dispersed material from cycling back into the mill.

The unit is produced in sizes of 4½ by 10 in., 6 by 14 in., 9 by 24 in., 12 by 30 in., 14 by 32 in., and 16 by 40 inches.

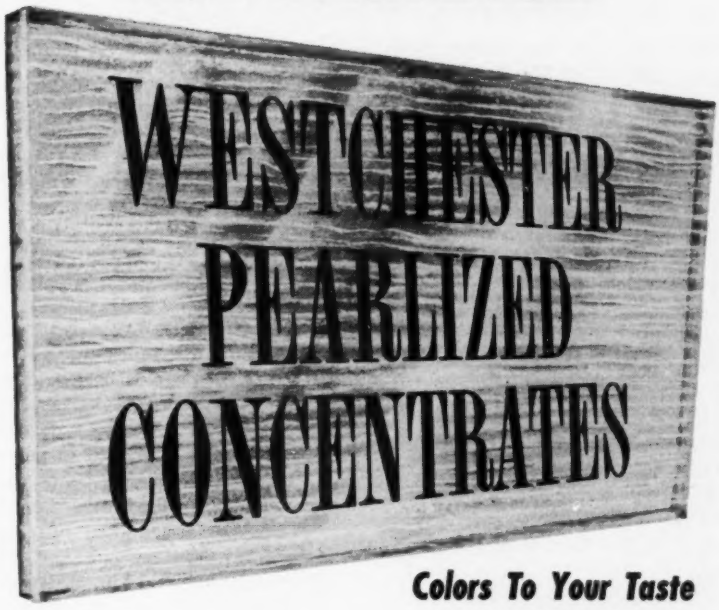
Compression Press—Greater molding speeds, more accurate sequence timing, quieter operation, lower maintenance, and longer press and mold life are claimed for a new 150-ton compression molding press designed by The Standard Machinery Co., and distributed by Davis-Standard Sales Corp., both of Mystic, Conn.

The press is of the toggle type and is reported to develop full 150-ton pressure with a 3-hp. motor. It uses differential cylinders for both compression and plunger molding. Ram and toggles are automatically lubricated and run in a totally enclosed spray of oil. Stroke is 8 in., and ejection is provided for both top and bottom platens. Main and transfer cylinders have cushioned valves at both ends of strokes.

Standard Machinery's toggle-type compression press develops full 150-ton pressure from a three-hp. motor



REAL PEARL APPEARANCE



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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Organic Coating Technology, Volume I," by Henry Fleming Payne

Published in 1954 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 674 pages. Price $10.00.

The first of two volumes intended to outline the current theory and practice of organic coatings, deals with the chemistry, manufacture, and use of oils, resins, varnishes, high polymeric materials, plasticizers, and driers as clear coatings and as vehicles or liquid portions of pigmented coatings. Following a chapter on the fundamental theories of film formation, the author—technical editor of American Cyanamid Co.—proceeds to discuss a variety of materials used in the organic coatings field, giving numerous specific formulations as well as outlining manufacturing steps. These materials include silicone, acrylic ester, vinyl, alkyd, and varnish resins, cellulosic polymers, volatile solvents, urea- and melamine-formaldehyde resins, and plasticizers. The book, a well systematized text for students of paint courses, will also serve as a good introductory manual for the novice in the paint and related industries.

"Experimental Inorganic Chemistry," by R. E. Dodd and P. L. Robinson

Published in 1954 by Elsevier Publishing Co., distributed in the U. S. A. and Canada by Elsevier Press, Inc., 155 E. 82nd St., New York 28, N. Y. 424 pages. Price: $6.50.

Beginning research chemists will find this volume a good guide to current laboratory practices in the experimental phase of inorganic chemistry. It discusses most of the basic techniques that are required in his work and provides a fairly thorough methodological foundation on which he can base his early experimental research efforts. The topics covered include general basic techniques (filtration, crystallization, desiccation, sublimation, heating, cooling, etc.); handling of gases; preparation and purification of gases and volatile compounds; water, alkalies, acids, and solvents; colloids and disperse systems; and the measurement of physical properties.

"Polymer Degradation Mechanisms," National Bureau of Standards Circular 525 (1953)

Published in 1953 by U. S. Government Printing Office, Washington 25, D. C. 280 pages. Price $2.25 (foreign $3.00).

The 17 papers in this volume were presented at a symposium held at the National Bureau of Standards during its Semicentennial in 1951. The theoretical aspects of polymer degradation are reviewed in papers by Jellinek and Simha. Other contributions describe experimental work on the breakdown of polymethyl methacrylate, polyvinyl and polyvinylidene chloride, polyacrylonitrile, polyethylene, polystyrene, polyamides, and cellulose esters. A record of the discussions that followed the presentation of the papers is included.

"Die Technologie der Klebstoffe," by C. Lüttgen

Published in 1953 by Wilhelm Pansegrau Verlag, Uhlandstr. 102, Berlin-Wilmersdorf, Germany. 426 pages. Price DM 34.80 (ca. $8.35) (In German).

Stated purpose of this volume is to bring to the German-speaking manufacturer and technician an up-to-date, practical picture of the various methods used in the manufacture of resin adhesives (including several of the more unusual types) as well as a survey of the range of applications that these adhesives have. An introductory chapter on the general theory of chemical adhesion is followed by a detailed discussion of the formulation of a large variety of adhesives, including information on weights and proportions of materials going into the formulation, necessary temperatures, conditions of cure, and the like. Wherever a patented process is involved, the patent number and the names of the holder of the patent and the inventor of process are given. The section on applications discusses adhesives in terms of their uses, e.g. adhering metal to metal, metals to non-metals, glass to glass, tape coatings, etc. Here again, formulation and patent information is provided.

Plastics pipe—A 17- by 24-in. wall chart lists specifications for the company's line of plastics pipe and fittings, including pipe for jet wells, submersible pumps, farm water systems, sprinkling systems, and high-pressure cold water and chemical lines. Working pressures for all sizes carried are included. *Yardley Plastics Co., 142 Parsons Ave., Columbus 15, Ohio.*

Ethylene compounds—This 33-page product bulletin describes in detail ethylene oxide, ethylene glycol, and diethylene glycol, their uses, chemical and physical properties, handling and storage procedures, and safety precautions. The behavior of each of the materials in the presence of other chemicals is presented in terms of complete reaction formulas. The bulletin also offers analytical procedures to follow to determine color, odor, acidity, impurities, boiling range, specific gravity, etc., for each of the three chemicals discussed. Text is supplemented by graphs pertaining to humectant values, dew points, specific gravity, vapor pressure, and other characteristics, as well as by a chart illustrating necessary equipment for unloading tank cars. *Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Plastics supply—The company's line of plastics rods, tubes, and sheets available to the end-product manufacturer in a variety of sizes is presented in this booklet. Among the materials in which these shapes are stocked are acrylics, acetates, vinyl, styrene, Teflon, nylon, phenolic laminates, and others. A special section, deals with properties. Complete price and ordering information is provided. *Commercial Plastics & Supply Corp., 630 Broadway, New York 12, N. Y.*

Steam traps—Two bulletins deal with a line of automatic valves which function to discharge condensate and air from a steam-heating system, but prevent the steam itself from escap-

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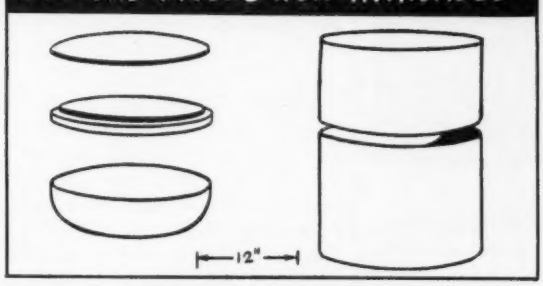

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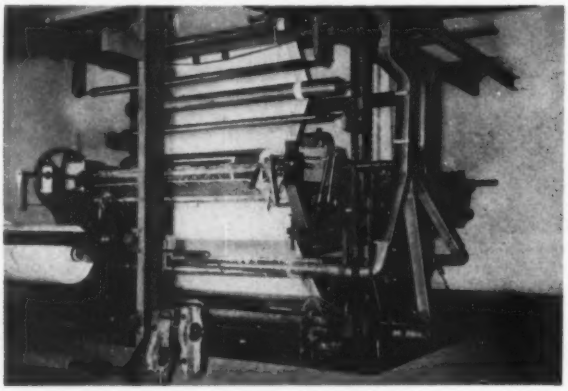

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ing. Bulletin T-1740 describes and schematically illustrates the operating principles of the company's "impulse" steam traps. It also gives installation and operation suggestions, a list of thermodynamic properties of saturated steam, and tables for the determination of trap size and for the calculation of size of return pipe lines. Price information is included. Bulletin 1750 lists various installations where steam traps can be effectively employed, giving the different size traps available and their respective capacities (lb. of liquid evaporated per hr.) for each application. *Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa.*

Packaging—Information on the applications of molded and blown plastics, coatings, adhesives, film, and rigid sheet material for packaging is contained in an 8-page "1954 Guide to Improved Packaging with Plastics and Resins." Illustrated with 48 photographs of actual applications, the booklet describes the major properties, advantages, and color and finish possibilities of polyethylene, phenolic, styrene, and vinyl. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Kel-F—Companies engaged in the molding, extruding, and fabricating of Kel-F, as well as those offering application services connected with Kel-F including corrosion control, dispersion applications, film sealing, tank lining, welding, and scrap cleaning, are listed in this 16-page revised buyers' guide. Three indices, which break down into convertors and processors, manufactured items, and services, plus a complete company listing make for easy cross-reference. *Chemical Manufacturing Div., The M. W. Kellogg Co., P. O. Box 469, Jersey City 3, N. J.*

Glass fabric—This set of loose-leaf pages covers the entire line of glass fabrics manufactured by the company and, in addition, contains information on specialized services rendered by it for custom weaving, impregnating, and coating to specifications. It includes descriptive data on uses of glass cloth, types available, physical characteristics, packaging, and prices. A 5-page section lists complete specifications for all

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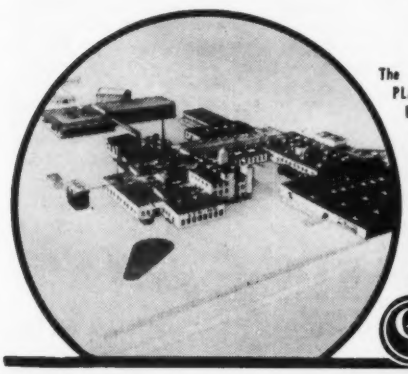

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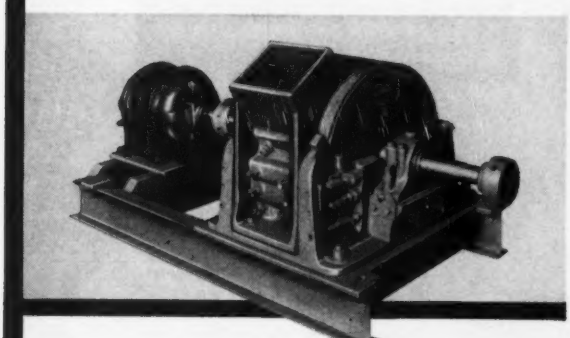

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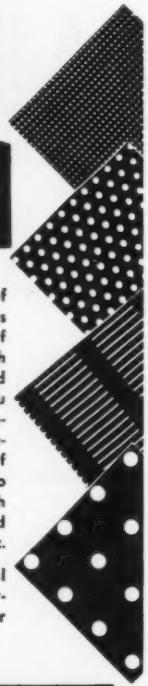

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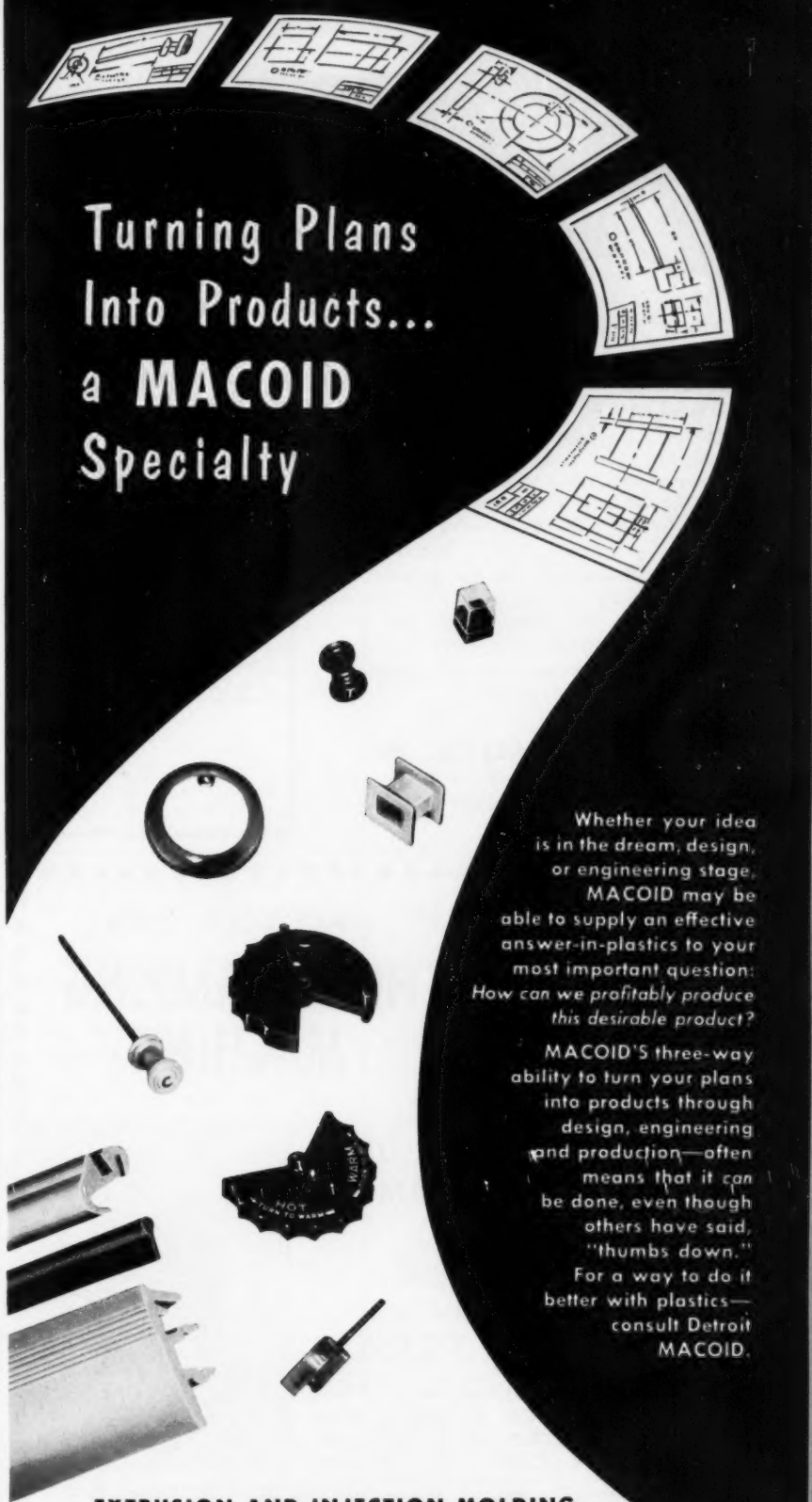
weaves, yarns, and constructions. Various finishes—heat treating, heat cleaning, and water repellency—offered by the company for improved surface characteristics of the glass cloth are discussed and numerous product data sheets dealing in detail with various of its products are provided. Among these data sheets are those covering vinyl-coated glass fabrics for automotive and upholstery application, impregnated glass cloth for use on boat hulls, phenolic-impregnated glass resins, glass fabric reinforced thermosetting adhesive film, and lagging cloth. *Coats Manufacturing & Supply Co., Box 71, Livermore, Calif.*

Press—Bulletin 516 describes a semi-automatic compression molding press of 150-ton capacity, claimed to be especially suited for molding capacitors, resistors, and similar parts requiring delicate insert work or having thin and thick sections. The unit incorporates a regenerative oil circuit for increased speed of initial closing and opening of toggle. *F. J. Stokes Machine Co., Philadelphia 20, Pa.*

Templets—This 6-page pamphlet gives step-by-step instructions for the making of glass cloth reinforced plastics drill templets and the embedding of triangular or rectangular laminate Anchor bushings at the appropriate drill hole location in the plastic after it has been cured. This process eliminates the hole pattern inaccuracies caused by shrinkage during curing, since the bushings are embedded only after cure. *The High-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif.*

Facilities—Properties of extruded and molded Kel-F, nylon, and Teflon rod, tubing, and sheet, as well as applications of these materials, are briefly outlined in this four-page folder. Also described are the firm's product development and fabricating facilities. *Flek Corp., 2252 E. 37th St., Los Angeles 58, Calif.*

Urea—A new process for the production of urea, said to result in lower operating costs, reduced initial investment, higher yields, high on-stream efficiency, and high product purity, is described in this 8-page booklet. The process, developed by the Montecatini Group, consists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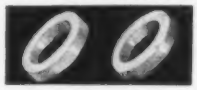

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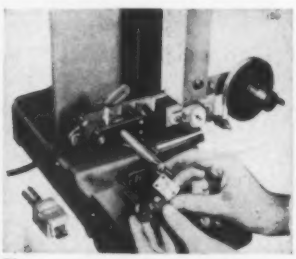

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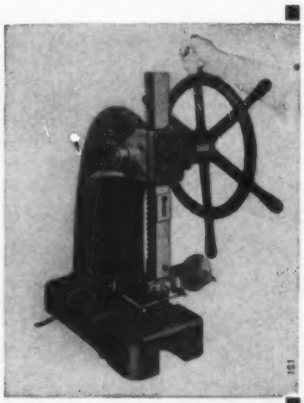

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Weigh-mixing—Technical Reference 53B describes a remote-control system for proportioning ground cellulose acetate and plasticizer. The entire cycle is discussed, starting with the weight selection of material and ending with the discharge of the proportioned product into a surge hopper. *Richardson Scale Co., Van Houten Ave., Clifton, N. J.*

Metallizing—Process equipment required for continuous vacuum coating and products made by that process are discussed in this brochure. Also covered are the company's background in this field and its patent and licensing policies. *National Research Corp., 70 Memorial Dr., Cambridge, Mass.*

Carbide—Uses of cemented carbides in high speed industrial processes, especially as applicable to automation of industrial plants, are described in this 26-page brochure. Also discussed are such other man-made "metals" as Hevimet, Alnico type magnets, and others. *Carboloy Dept. of General Electric Co., Detroit 32, Mich.*

Efficiency—"More Dollars From Less Space" describes the various components of and advantages to be derived from a system for improving the efficiency of production lines. The elements of the system comprise a specially designed work bench, a 3-in. wide power channel in back of the work bench, arranged in the vertical plane and accommodating electric, hydraulic, and air power lines, as well as outlets to make that power conveniently available to the operator, and parts containers with high visibility to improve part flow. The booklet cites various instances where the installation of the company's system

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has resulted in savings on floor space and increased production efficiency. *Alden Systems Co., Alden Research Center, Westboro, Mass.*

Management—Proceedings of the 17th Annual Time and Motion Study and Management Clinic contain complete transcripts of talks by labor, management, and government executives on time study, motion economy, methods, plant layout, materials handling, wage incentives, maintenance, and human relations. Price $4.00. *Industrial Management Society, 35 E. Wacker Dr., Chicago 1, Ill.*

Packaging—Fact Sheet "F" describes the history, operations, and products of the company's Shellmar-Betner Flexible Packaging Div. It describes the materials used, and its sales, research, equipment development, and service activities. *Continental Can Co., Inc., 100 East 42nd St., New York 17, N. Y.*

Universal language—"Spectroscopia Molecular," written entirely in Interlingua—an artificial language which combines elements of English, French, Italian, Spanish, Portuguese, and some German, and now has a vocabulary of over 27,000 words, of which 17,000 are technical terms—is a monthly bulletin of news and information of interest and value to the molecular spectroscopist *(es un bulletin mensual de novas e informationes de interesse e valor al spectroscopistas molecular)*. Annual subscription price $2.00. Also available is a monograph—written in the same tongue—explaining the methods of obtaining the selection rules for the vibrational spectra of polyatomic molecules, both linear and non-linear. 25 pages. Price 75¢. *Illinois Institute of Technology, Chicago 16, Ill.*

Research projects—With the purpose of stimulating further research efforts, the Administrative Committee on Research of A.S.T.M. has compiled a 19-page booklet, entitled "Some Unsolved Problems," which outlines a number of questions to which no satisfactory answers have as yet been found. The booklet states each problem, the present state of knowledge, the questions that need to be answered, and introductory references. While none of the prob-

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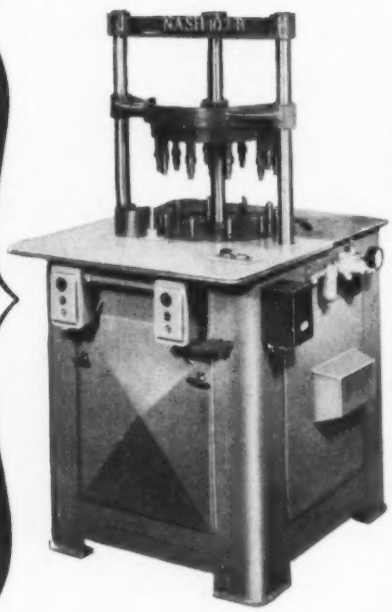

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lems deals specifically or exclusively with plastics, several have a bearing on the plastics industry, e.g., matters of corrosion, fatigue, and the like. *American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.*

Solvent recovery—A system to recover volatile solvents which would otherwise be exhausted into the atmosphere is described in this 4-page booklet. The system has a two-fold purpose. It cleans the air surrounding an industrial establishment and at the same time makes recovered solvents available for re-use. According to the manufacturer of the equipment, one installation in a laminating plant recovered over 2000 gal. of re-usable denatured alcohol daily. Basically, the system operates through the use of adsorbent activated carbon, into which solvent-laden air is blown and from which clean air and recovered solvent emerge. *Solvent Recovery Div., Barnebey-Cheney Co., Cassady at 8th Ave., Columbus 19, Ohio.*

Research service—"Scientific Sleuthing" describes a literature research organization offering technical, patent, and economic surveys of all magnitudes, abstracts of current technical information, bibliographies, and translations. *Armour Research Foundation, Illinois Institute of Technology, 35 W. 33rd St., Chicago 16, Ill.*

Laboratory equipment—Bulletin 700 presents a line of pilot plant and laboratory equipment, including attrition mills and portable mullers, proportioning pumps, blending machines for powdered materials, electric-heat autoclaves, steam-jacketed sterilizers, hand-drive and motor-drive tumble jars, portable refrigerators, etc. Photographs, descriptions, ordering information, and prices are included. *Andrew Technical Service, 6972 N. Clark St., Chicago 26, Ill.*

Ovens—The complete line of the company's "isotemp" ovens (uniform-temperature units heated by their own aluminum walls) is listed and described in this 8-page bulletin. It also gives a brief resume of the basic heat transfer studies which led to the development of the isotemp oven. *Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.*

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TO INFINITY

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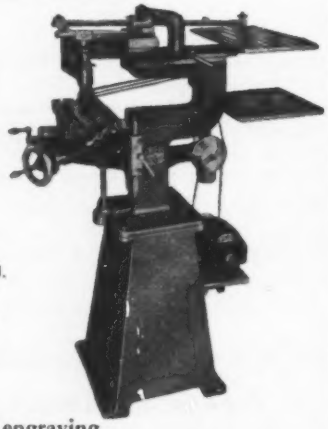
ENGRAVER



- Engraves to centre of a 30" wide panel.
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For 2 Dimensional engraving this machine is very widely adaptable. It takes large or small work and being strongly built to high precision is not limited to use on plastic. It can be used for engraving metals including steel, too.

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant, for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION IN [illegible] From Statistics Compiled

Materials
CELLULOSE PLASTICS:[a]
Cellulose acetate and mixed ester:
Sheets, under 0.003 gage
Sheets, 0.003 gage and over
All other sheets, rods, and tubes
Molding and extrusion materials
Nitrocellulose sheets, rods, and tubes
Other cellulose plastics
PHENOLIC AND OTHER TAR-ACID RESINS:
Molding materials[a]
Bonding and adhesive resins for—
Laminating (except plywood)
Coated and bonded abrasives
Friction materials (brake linings, clutch facings, and similar materials)
Thermal insulation (fiber glass, rock wool)
Plywood
All other bonding and adhesive uses
Protective-coating resins, unmodified and modified except by rosin
Resins for all other uses
UREA AND MELAMINE RESINS:
Textile-treating and textile-coating resins
Paper-treating and paper-coating resins
Bonding and adhesive resins for—
Plywood
All other bonding and adhesive uses, including laminating
Protective-coating resins, straight and modified
Resins for all other uses, including molding
STYRENE RESINS:
Molding materials[a]
Protective-coating resins, straight and modified
Resins for all other uses
VINYL AND VINYL COPOLYMER RESINS, total[b]
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for—
Film (resin content)
Sheeting (resin content)
Molding and extrusion (resin content)
Textile and paper treating and coating (resin content)[c]
Flooring (resin content)
Protective coatings (resin content)
All other uses (resin content)
All other vinyl resins for—
Adhesives (resin content)
All other uses (resin content)
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:
Molding materials[a,d]
Protective-coating resins[e]
Resins for all other uses[f]

* Dry basis is designated unless otherwise specified.
† Revised. ‡ Partially estimated.
a Includes fillers, plasticizers, and extenders. b Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. c Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

POUNDS" FOR NOVEMBER AND DECEMBER [illegible] by U. S. Tariff Co[illegible]

November		December	
Production	*Sales*	*Production*	*Sales*
1,513,195	1,678,007	1,739,821	1,383,537
1,062,622	889,721	1,307,294	922,615
422,936	382,271	435,425	400,971
5,802,855	6,027,907	6,226,012	5,726,422
633,101	509,943	630,605	550,605
401,407	437,124	485,958	414,476
17,616,857	15,093,209	15,129,734	13,125,405
†5,141,216	†3,122,457	‡5,410,063	‡3,587,803
605,105	631,727	628,009	810,029
931,794	985,295	1,306,107	981,256
†2,004,675	†2,326,347	‡1,755,360	‡1,915,550
†3,074,862	†2,653,848	‡2,840,682	‡2,308,586
†1,317,611	†1,281,750	‡1,213,589	‡1,369,062
†1,372,952	†1,507,579	‡1,448,923	‡1,948,944
†1,655,900	†1,509,299	‡1,981,412	‡1,599,609
†2,807,653	†2,774,324	‡2,763,452	‡2,820,124
†1,546,931	†1,593,484	‡1,246,813	‡1,439,417
†4,529,068	†4,057,224	‡4,421,746	‡4,586,552
†3,005,252	†3,040,976	‡2,582,658	‡2,802,037
†2,576,649	†1,916,885	‡2,697,131	‡1,633,065
5,950,475	5,781,478	5,940,478	5,423,807
†19,277,852	†22,043,392	‡19,078,519	‡22,753,927
†7,136,632	†6,434,773	‡7,731,923	‡7,438,968
†6,482,421	†5,590,606	‡6,829,415	‡6,432,130
39,129,446	35,610,020	37,357,252	41,676,295
—	4,506,610	—	4,965,284
—	4,125,971	—	4,579,357
—	9,443,228	—	12,468,815
—	3,614,726	—	4,024,132
—	1,446,704	—	1,549,029
—	1,560,986	—	1,789,029
—	2,445,697	—	3,456,146
—	1,754,832	—	1,721,398
—	6,711,266	—	7,123,105
15,948,167	14,458,131	14,205,007	14,094,278
16,416,497	12,106,328	17,259,655	13,654,049
893,321	362,506	381,442	384,818
9,934,395	9,287,512	8,839,811	10,074,730

data for spreader and calendering-type resins. d Includes data for acrylic, polyethylene, nylon, and other molding materials. e Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. f Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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- Acrylic
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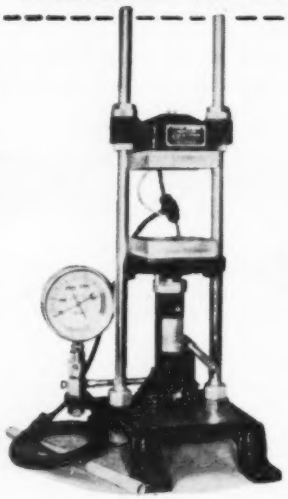

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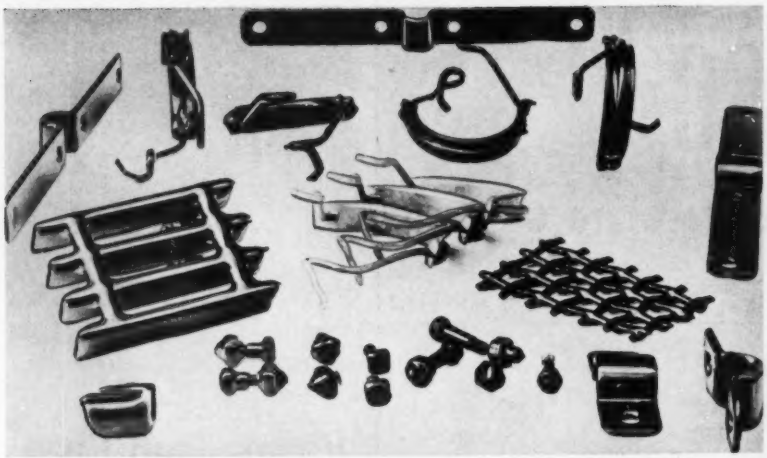


Steel grating, wire mesh screening, bolts, nuts, and clamp rings stand up under exposure to most industrial acids and chemicals when protected with plastisol coating

Vinyl Plastisol Anti-Corrosion Coating

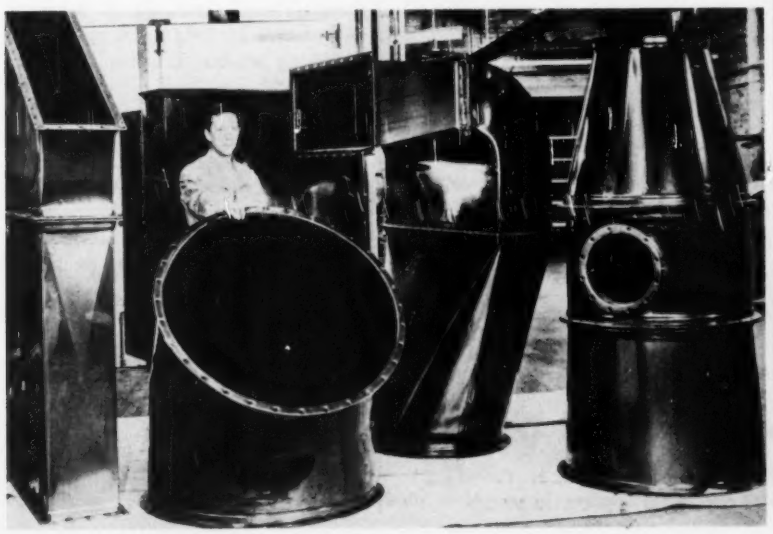
SERVICE life of large chemical processing equipment exposed to corrosive fumes is extended and maintenance costs are reduced by the application of a tough, baked-on coating of a specially compounded formulation of vinyl resin-based plastisol.

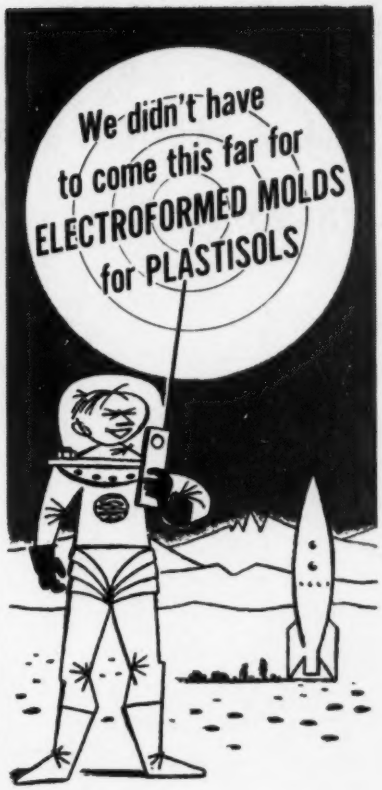
The coating is applied in uniform thicknesses of from 1/32 to 3/16 in. to the metal and is then fused to the surfaces. Welding or cementing of seams, joints, or other points of chemical deterioration are not required since the coating forms a continuous protective sheath over undercuts and crevices as well as flat surfaces.

Tanks, heavy castings, fume exhaust stacks, and flanged pipe sections can be coated with the chemically inert material as protection against abrasion, rusting, blistering, and general deterioration caused by exhaust gases that contain acids, alkalies, moisture, mineral salts, and similar components.

CREDITS: Quelcor coatings supplied and applied by Quelcor, Inc., Chester, Pa.; vinyl resin-based plastisols supplied by Bakelite Co.

By coating the duct sections of a fume exhaust system with vinyl plastisol, the equipment is given a non-porous surface that withstands abrasion and corrosive fumes.





NO NEED for interplanetary travel; Plastiplate Co. is much handier! Starting with no more than your design for a plastisol molded product—we'll construct your waxes and masters, then deliver to you as many complete molds as your production line requires.

And they'll be *precision*, close tolerance, "peas in a pod" molds; uniform in weight and dimensions to insure maximum uniformity in production.

Mold size is no obstacle, either. Our facilities are adapted to the accurate manufacture of even extremely intricate units. Moreover, your Plastiplate molds can be delivered to you complete with all necessary jigs and fixtures, ready for immediate use.

Ask for details today.

P. S. Remember too that Plastiplate is one of the country's largest and most experienced electroplaters of such small plastic pieces as buttons, beads, and novelties. Any metal finish, any color.

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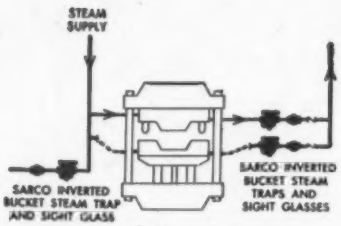
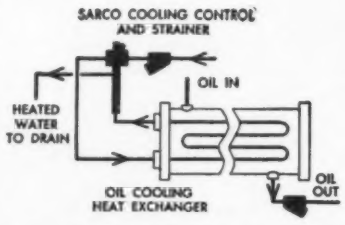
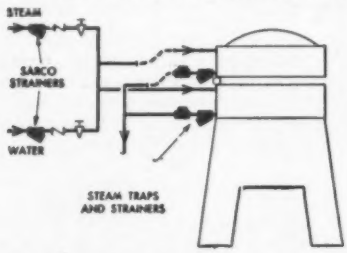


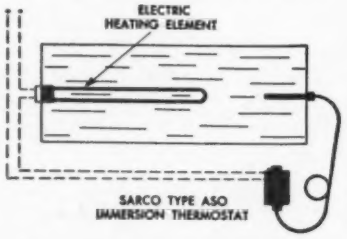
Compression molding press fitted with Sarco Inverted Bucket Steam Traps, the blast discharge of which scours the heating surface of the platens.



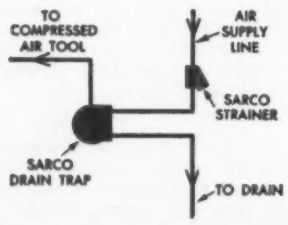
Heat exchanger cools hydraulic oil of plastics molding machines. Temperature of the cooling water is regulated by the Sarco Cooling Control.



Sarco steam traps on a steam-heated and water-cooled molding press.



Annealing bath temperature controlled by Sarco type ASO electric immersion thermostat.



Sarco Type F.A. trap draining small line to compressed air tool.

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Send us a sketch of your hook-up problem, we'll check it and send you our recommendations without cost or obligation.

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.
SARCO CANADA LTD., TORONTO 8, CANADA

Power tool kit is neatly housed in transparent, hinged styrene case

Power Tool Case

PRECISION power tool kit uses molded plastics parts to advantage in the construction both of the power tool and of the compact, serviceable case in which the kit is housed.

Four major components of the power tool—front head, terminal block, switch member, and switch cap—are compression molded of phenolic and machined to very close tolerances.

The hinged case in which are packed the power tool and the 40 accessories that are supplied with it is injection molded of clear styrene. The bottom half of the case is divided into two compartments by a raised deck that fits snugly into one corner. This deck is molded separately and is inserted into the case by fitting two lugs molded into the bottom of the deck into two holes which are machined into the bottom of the tool case.

To accommodate the 40 accessories—which include grinding wheels, polishing wheels, brushes, and cutters—39 holes and one square-shaped pocket (for an abrasive block) are molded into the top surface of the deck. A thick-walled hook, which projects from one end of the deck and serves as a rest for the head of the power tool, is also molded-in. If desired, the deck can be easily removed from the case for cleaning.

The lightweight case is strong, easy to clean, and will resist moisture, oil, grease, and most chemicals.

CREDITS: Power tool kit manufactured by Selectric Products Co., Lynwood, Calif.; styrene supplied by Bakelite Co., Div. Union Carbide and Carbon Corp.

Compressing 200,000 square feet into 60

You're looking at a giant titanium plant in miniature—as set up in the Glidden Laboratories in Baltimore. It is a small-scale "plant" that transforms jet black titanium ore into gleaming white pigment. This hydrolysis process provides an accurate check on every shipment of titanium ore received by Glidden.

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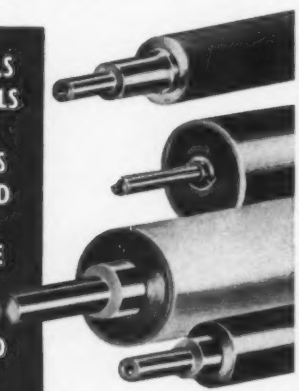

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Speaker Coating

IMPROVEMENT in sound quality and, at the same time, reduction in fatigue failure, are both achieved on the new line of Stromberg-Carlson radio and television loudspeakers through the application, during speaker production, of a coating of specially formulated Geon vinyl latex to the speaker cone edges.

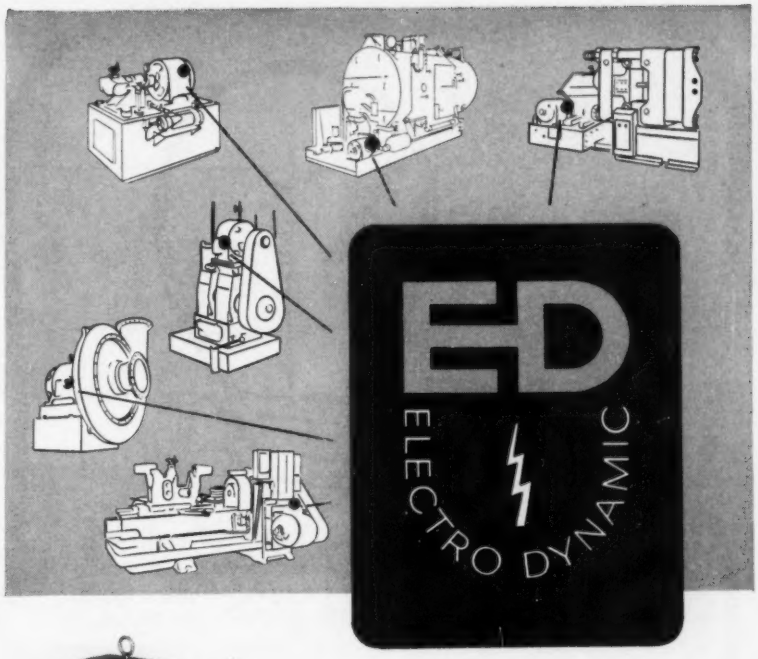
The vinyl latex contributes to the acoustical fidelity of the speakers by repressing the reflections, at the cone edges, of the sound traveling along the paper cone from the voice coil mounted at the apex. This damping action reduces the amount and the intensity of vibration interference, thereby smoothing out the frequency response of the instrument and enhancing the over-all quality of tonal reproduction.

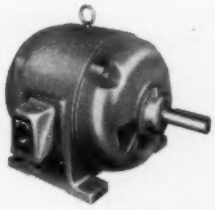
In addition to its acoustical functions, the coating also serves to counteract the effects of normal usage and aging on the speaker by strengthening the paper material along the rim of the speaker cone. Because of this, the incidence of fatigue cracks—long a source of bothersome annoyance to the discerning listener—is said to have been completely eliminated.

In actual loudspeaker production, the Geon coating is manually applied by brushing the liquid vinyl latex along the outer edges of the speaker cones and then heat-fusing it in an oven.

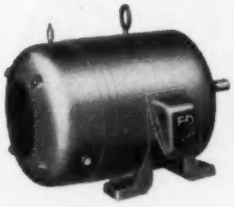
CREDIT: Geon vinyl latex supplied by B. F. Goodrich Chemical Co.

Vinyl latex for loudspeaker coating is applied to cone edge by brush





THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY



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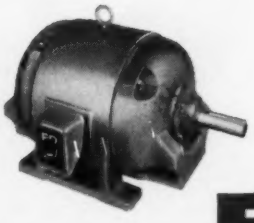
Conclusive evidence of the *extra dependability* of Electro Dynamic motors is now revealed in the new candid report **"MOTOR SHOWDOWN"**. The revealing proof is found in *comparative tests** conducted in accordance with A.I.E.E. standards. Don't miss your copy! Send the coupon below *today*.

*Tests certified by J. Arthur Balmford, Professor of Electrical Engineering at a leading Eastern university.



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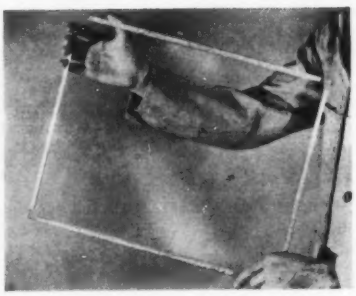

Clear, flexible butyrate glazing material adds to industrial safety

Safety Window

POSSIBILITIES of extensive damages to building and injuries to personnel resulting from industrial explosions have been minimized at a plant of Emery Industries, Inc., with the installation of transparent, flexible cellulose acetate butyrate glazing panels in place of the conventionally used glass panes in all the windows of the building. Emery's is reported to be one of the first industrial establishments to be equipped with this type of plastic safety window.

In the event that a blast occurs in the plant as the result of a sudden ignition of gas or air-borne dust, the flexible butyrate panels bow and pull away from the casing. This action makes it possible for pressure to be quickly released before a dangerous build-up can take place. As a result, the possibility of walls and window frames being blown out is eliminated. In addition, because the plastic panels, unlike conventional window glass, will not shatter, hazards of flying, sharp-pointed fragments of glass are also overcome.

The butyrate panes are cut to the required size from extruded sheet. Thin galvanized metal strips are crimped over all four edges to provide a ⅜ in. wide binding. This binding gives added rigidity and also provides a convenient surface for the application of putty. Techniques for the installation of butyrate panels are said to be simple and not to differ materially from those used when setting glass panes in conventional frames.

CREDITS: Glazing panes manufactured by General Plastics Co., Marion, Ind., from Tenite II cellulose acetate butyrate supplied by Eastman Chemical Products, Inc.

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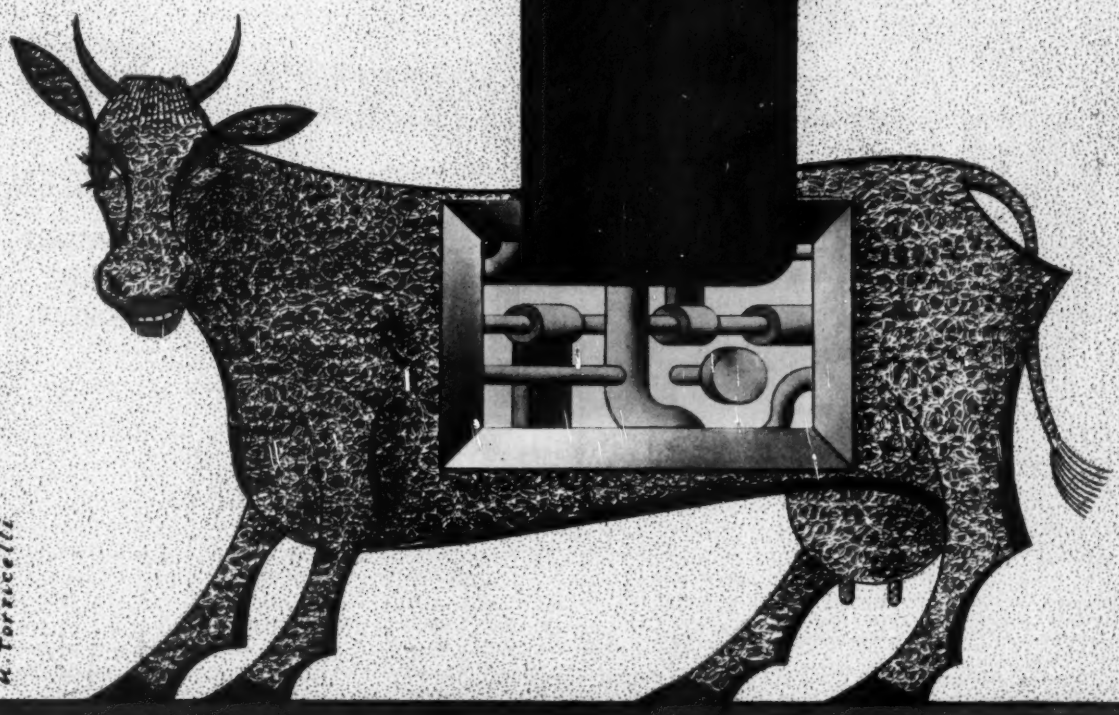

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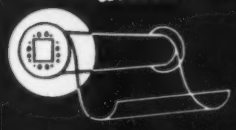
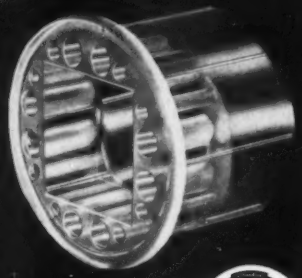


No more trouble from this 3 ¾" diameter core for photographic film, because A. L. Hyde molded it from butyrate. Presses from 4 oz. to 200 oz.



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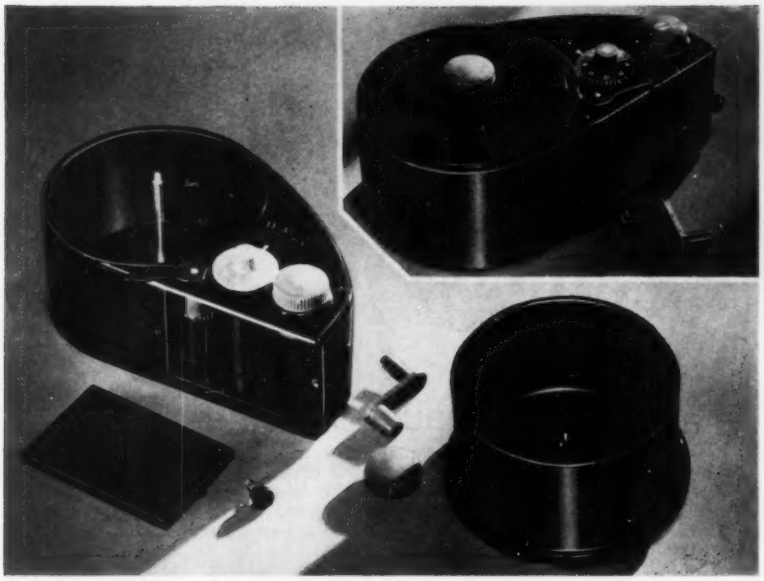

Phenolic parts for all-plastics film loader (inset) include (left to right): panel door, housing, and circular lid (inverted). Crank and knob (center) are styrene

Phenolic and Styrene in Film Loader

INCORPORATING molded phenolic and styrene parts, a new all-plastics film loader is finding excellent reception among users of 35-mm. film.

The loader is designed to be used with any type of 35-mm. bulk film, either spooled or unspooled, and can reload film cartridges quickly and accurately in full daylight.

The four major parts of the loader are compression molded to very close tolerances of general-purpose phenolic. These parts, which weigh a total of 18½ oz., include the housing, a circular lid with deep skirt which serves as a light trap for the film supply in the large end of the housing, a panel door that opens to give access to the film loading section, and a top lid which covers the smaller end of the housing. The housing is produced in a single-cavity mold and the other three parts in 2-cavity molds. To facilitate assembly, various threaded metal inserts and projecting spindles are molded directly into the housing.

Seven styrene parts—three knobs, a two-piece bearing assembly for the film cartridge, and a winding crank for turning the cartridge—are injection molded in a 7-cavity family mold. Threaded metal inserts are also molded into two of the knobs and part of the bearing assembly.

Finishing operations after molding — which involve deflashing the phenolic parts, reaming holes, degating styrene parts, and painting numbers on the counting knob—take only 4 min. to complete; assembly is accomplished by hand in 3½ minutes. Phenolic parts are molded in black and styrene parts in red — making the loader as attractive as it is practical.

CREDITS: Molded by Recto Molded Products, Inc., Cincinnati, Ohio, for Burke & James, Inc., Chicago, Ill.; phenolic supplied by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.

Film cartridges can be quickly reloaded even in full daylight

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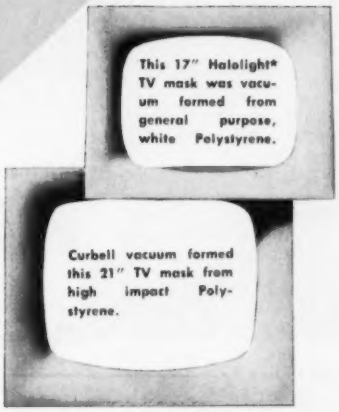
This 17" Hololight* TV mask was vacuum formed from general purpose, white Polystyrene.
Curbell vacuum formed this 21" TV mask from high impact Polystyrene.

Many manufacturers are finding that vacuum formed components can replace metal, wood and moulded parts at far less cost while stepping up product appeal and service. These economies are due to the low cost of tooling and faster delivery with vacuum forming methods. Leading TV, Lighting and Electrical Appliance manufacturers are a few of the many diversified customers that Curbell has served in supplying vacuum formed parts in a wide variety of shapes and sizes.

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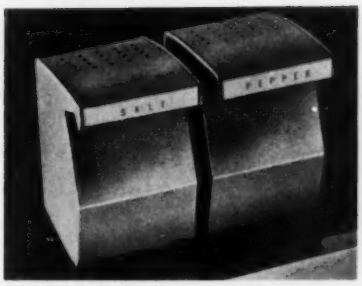


Intricately designed, heat-resistant salt and pepper shakers are molded of urea

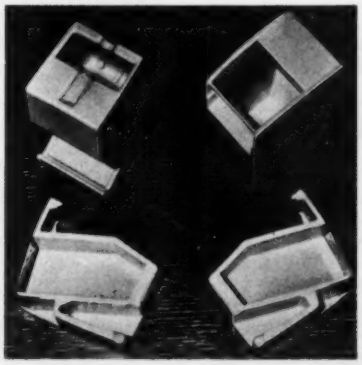
Condiment Set

SALT and pepper set for mounting in the backguard of General Electric Co.'s new deluxe ranges is molded of urea in a 6-cavity mold. Perforated cover plates of stainless steel snap-fit into place at top of the shakers.

The design of the shakers (giving the illusion of being wider at base of well than at top—see bottom photo for details) posed problems of parting line and angle of forces which required extensive machine work on the mold and, after test pieces had been produced, mold modifications to strengthen certain sections and make revisions in fillets and undercuts.

In molding the pieces, control of shrinkage was particularly important since the steel cover had to fit precisely. Equally important was the prevention of undue pressures on the lower, long cored sections, since they are at an angle.

CREDITS: Shakers are molded by The Patent Button Co. of Tennessee, Knoxville, Tenn., of Beetle urea supplied by American Cyanamid Co.



Bottom (top left), top (top right), and cut-away views of new shakers.

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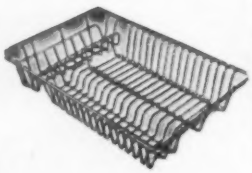

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Shelf Guard

GLASS bottles, jars, and other breakable containers with a tendency to tumble out of the home medicine cabinet as soon as its door is opened and shatter into sharp-pointed fragments on the floor or in the wash basin can now be kept securely in place with an easily installed shelf guard made of extruded translucent, neutral-colored Tenite II cellulose acetate butyrate.

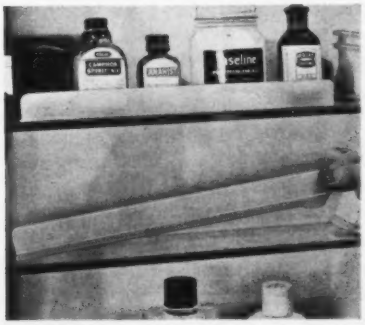
The unit is 10 in. wide, fitting most present-day medicine chests, and is slightly less than 1 in. high—sufficient to keep most toilet articles from falling out of the cabinet. Thickness of the guard varies from 0.040 in. for the upright portion to wafer-thin at the rear of the horizontal part. This taper avoids the creation of step formation on the shelf and thus provides practically as level a support to the containers as the shelf itself.

Fabrication of the guard rail consists of cutting the continuous extrusions into 10-in. lengths, rounding the corners, and applying a double-coated, pressure-sensitive adhesive tape to the underside of the horizontal part.

To install the guard in the cabinet, the protective coating is stripped from the tape and the exposed adhesive surface simply pressed into place on top of the shelf on which it is to stand. It will adhere equally well to glass, metal, or wooden surfaces.

CREDITS: Shelf guard fabricated by Metro Mercantile Co., Los Angeles, Calif., from Tenite II butyrate extruded by Jet Specialties Co., Los Angeles, and supplied by Eastman Chemical Products, Inc., No. 400 double-coated, pressure-sensitive adhesive tape manufactured by Minnesota Mining and Mfg. Co.

Butyrate shelf guard prevents bottles from falling out of medicine cabinets



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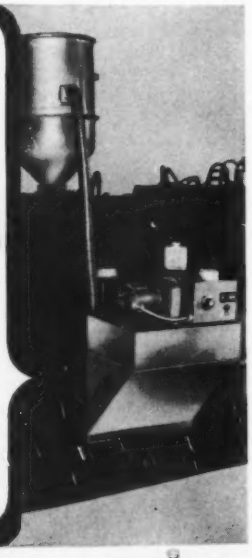

New Hopper Loader — For continuous automatic feed of any injection or extrusion machine. Clock timer control for starting and stopping. Dust-free operation. **"Die-Temp" Control** — Positive-acting, self-contained mold temperature control at any level between 100-400 degrees F. Fast, compactly built to save space.

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Bodies of high-voltage standoff terminals are transfer molded of melamine

Tiny Insulators

MINIATURE insulated standoff terminals for use as high-voltage tie-points on aircraft are now being made with mineral-filled melamine bodies as small as $\frac{1}{8}$ in. wide and $\frac{1}{16}$ in. high. The melamine bodies are said to assure optimum characteristics for dielectric strength, arc resistance, and resistance to temperature and atmospheric extremes. The terminals have been successfully tested for standard shock and vibration. They have also been exposed to 15- and 25-G stresses for one-hour periods without any impairment.

At its bottom end, each insulator has a drilled and tapped metal hexagonal nut, purpose of which is to facilitate installation of the component by allowing tightening with a wrench without exerting undue strain on the plastic body. The top has a ferruled metal insert for attachment of the wiring.

Melamine bodies of insulated stand-off terminals are produced by transfer molding. Top and bottom metal components are molded-in, resulting in sturdy, molded-together finished assemblies.

CREDITS: Standoff terminals produced by Garde Manufacturing Co., Providence, R. I.; melamine bodies molded of mineral-filled Melmac 592, supplied by American Cyanamid Co.

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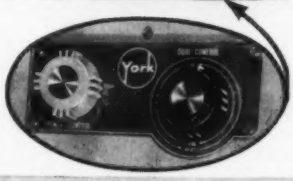
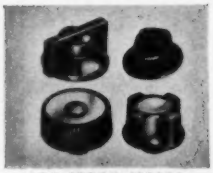


York Window Model A75MR with Reverse Cycle. Control knobs by Rohden.



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Thus writes Mr. E. M. Elliott, General Manager, Plas-Steel Products, Inc., of Walkerton, Indiana. Plas-Steel supplies more than a million glass rod blanks, annually, to the fishing rod industry.

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L·O·F roving is made of glass fibers possessing tremendous tensile strength (250,000 lbs. per sq. in.).

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Pipe Standards

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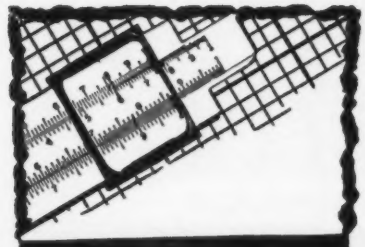
CREDITS: Pressurated pipe made by Yardley Plastics Co., Columbus, Ohio.



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The trim material is extruded of transparent yellow acetate in the profile of a pin, the pin "head" being the narrow hollow tube—0.065-in. I.D. and 0.080 O.D.—and the "shank" a solid ¼-in. tab. The trim is then cut to 20-ft. lengths and passed on to the metallizing operation where a white metal is deposited inside the hollow tubing. The finished trim is then cut to size and bent to fit the box.

Each ring box is molded with a narrow slot around the edge into which the tab of the trim is fitted, leaving only the metallized tube visible. The box is then lined with velvet and satin that combine with the acetate trim for luxurious appearance.

CREDITS: Ring box manufactured by Electric City Box Co., Buffalo, N. Y.; gold trim extruded by Streamline Plastics Co., New York, N. Y., using Tenite I cellulose acetate supplied by Eastman Chemical Products, Inc.; trim is metallized by Gomar Mfg. Co., Inc., Newark, N. J.

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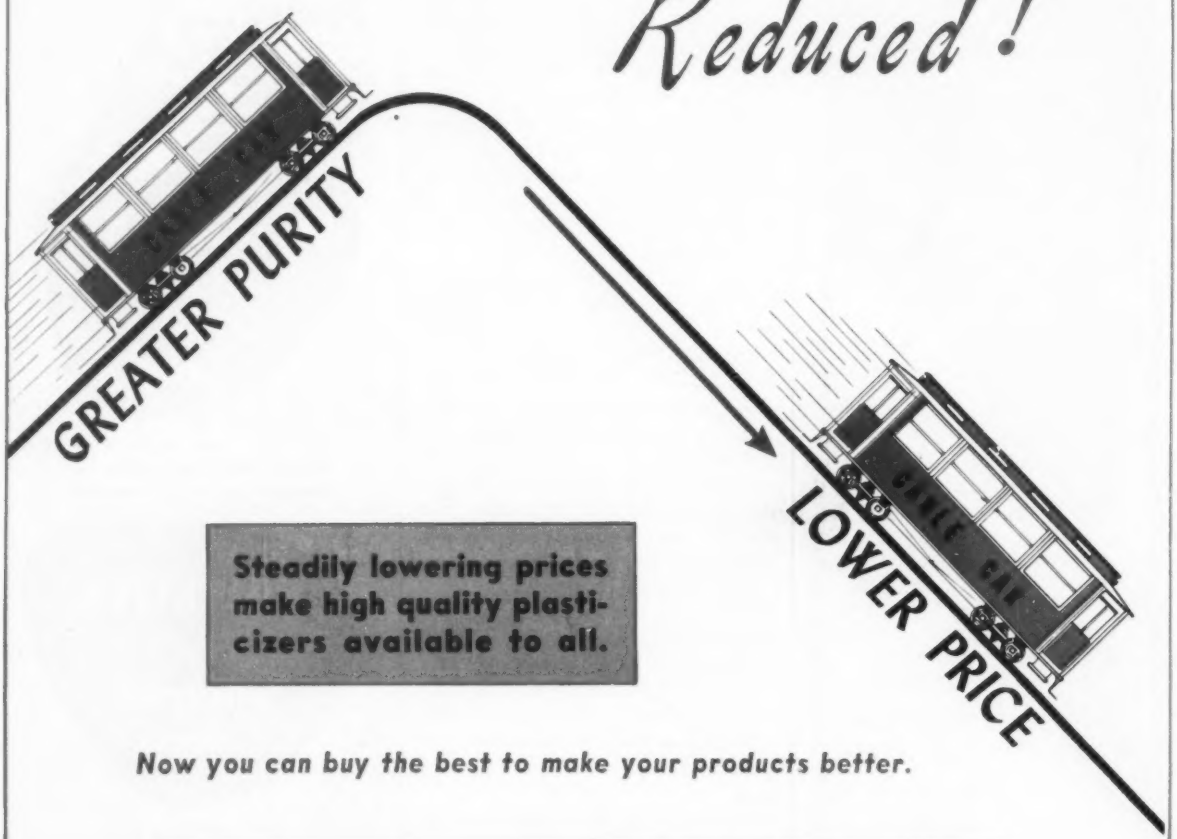

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RIGID PLASTICS PIPE. Leaflet lists the advantages and standard dimensions for the rigid thermoplastic pipe manufactured in regular and extra-heavy weight by Carlon Products Corp. (D-402)

UNIVERSAL TESTING MACHINE. Data on the Baldwin-Emery SR-4 universal testing machine of 50,000 lbs. capacity for testing specimens or parts in tension, compression, flexure, torsion, alternating load, creep, stress relaxation and shock. Baldwin-Lima-Hamilton Corp. (D-403)

STYRENE ALLOY. Booklet contains application information and engineering data on "Campco" S-300, a new alloy of polystyrene and rubber in rigid sheet form. Among its advantages are low cost, fine surface finish, and excellent impact resistance. Chicago Molded Products Corp. (D-404)

AUTOMATIC CYCLE TIMER. Folder explains the operation of the Daniels automatic process timer for controlling the cycling of hydraulic presses equipped with piston valves. T. H. & J. Daniels, Ltd. (D-405)

"DUREZ PLASTICS NEWS." Vol. 22, No. 2 of this house organ contains information on appliance, industrial, electronic and other applications of Durez thermosetting materials. Durez Plastics and Chemicals, Inc. (D-406)

HIGH STYRENE BUTADIENE COPOLYMERS. Three suggested formulas by which users can obtain high quality, low cost stock for manufacturing shoe soles, floor tile and similar products. Dewey and Almy Chemical Co. (D-407)

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HYDRO-PNEUMATIC ACCUMULATORS. Data on the construction, function, and operation of hydro-pneumatic accumulators for hydraulic power systems. Tells the jobs accumulators will do and how to choose them for various applications. Greer Hydraulics, Inc. (D-410)

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INJECTION MOLDING MACHINE. Bulletin on Reed-Prentice 200 and 300 ounce injection molding machines, and typical articles which may be molded on them. Illustrates and describes other machinery in this manufacturer's line. Reed-Prentice Corp. (D-416)

MARKING TOOLS. Booklet describes the various marking dies, number and letter sets, trademark stamps, and press marking dies available from The Parker Stamp Works. (D-417)

MOLDING PLANT FACILITIES. Illustrations and a description of the design, moldmaking and injection molding facilities available to manufacturers at Quinn-Berry Corp. (D-418)

"PLASTICS NEWSFRONT." Latest issue of this house organ is devoted mainly to applications of "Melmac" Resin 405 as used in laminates for cabinet work, office furniture, and kitchen and bath. Also illustrates applications for other "Melmac" and Laminac" resins. American Cyanamid Co. (D-419)

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PLASTICS FACILITIES. Bulletin shows how plastics jobs are handled in the engineering and design, mold making, compression, transfer and injection molding, and finishing departments of P. R. Mallory Plastics, Inc. (D-443)

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Circuitry

(*Continued from p. 99*)

costs are for a master drawing and a photographic negative.

Commutators such as this code disk usually turn at high speeds and the wear resistance of the conductor pattern as well as the insulating backing must be good. To prevent contact bounce, the surface of the conductor must often be flush with the surface of the insulator. For the code disk application, the best plating for the copper found to date is rhodium over nickel; the insulator is melamine-glass laminate having a melamine-paper surface with which the circuit is made flush.

Another application of printed circuitry in which not only the wiring but also coils and capacitors are printed is shown in Fig. 27. This device is a filter to eliminate interference in television sets and is of importance to the whole subject of printed circuitry because it illustrates the use of thin material to produce capacitors of up to 200 mmf. per sq. in. of area. The laminate base is of glass cloth impregnated with a phenolic resin modified for flexibility; copper foil is laminated in the usual manner to both sides. With such a material, capacitors and coils can be produced at a cost lower than conventional units—and since they are integral parts of the printed circuit, assembly costs are eliminated.

By far the greatest amount of etched circuitry has been manufactured using a paper-base phenolic laminate as the insulating support for the conductor pattern. Good electrical properties combined with relatively low cost account for this fact. For applications where especially good electrical properties, such as high surface resistivity or low dielectric loss, are required, grade XXXP is called for. In the usual printed wiring device, however, grades XXP or XP are more than satisfactory. Thus, a printed bifilar coil strip for a television i.-f. strip may require grade XXXP laminate, whereas a printed five tube home radio chassis will take grade XP.

Melamine

Melamine-fibrous glass laminate grade MGB has been used in many cases, particularly in military devices where somewhat higher temperature resistance or better arc resistance is needed. Its greatest disadvantage is its high moisture absorption which makes necessary a protective coating or vacuum impregnation treatment where high humidity conditions are to be encountered. It is also difficult to fabricate bacause of the abrasive effect which it has on drills and piercing dies.

Epoxy

A material which is beginning to attract widespread interest is epoxy-glass laminate. Its very low moisture absorption, high arc resistance, high temperature resistance, and low dielectric losses justify its cost and dictate its use in many situations. Since epoxy resins are excellent adhesives, no special bonding film or adhesive coating is required to bond copper foil to the laminate. The copper foil is simply placed in the laminating press with the sheets of epoxy-impregnated glass cloth. The impregnating resin acts as the bonding agent for the copper foil.

At first glance, this might appear to be the cure-all for printed circuit problems, but even it has its disad-

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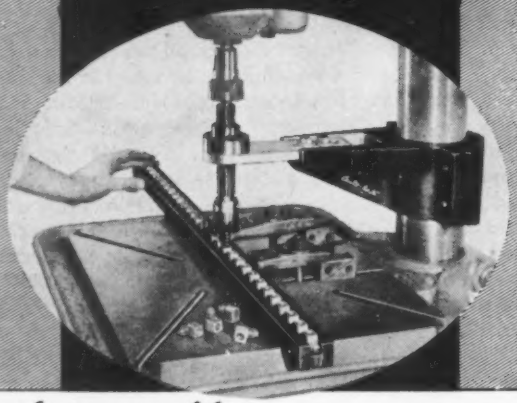

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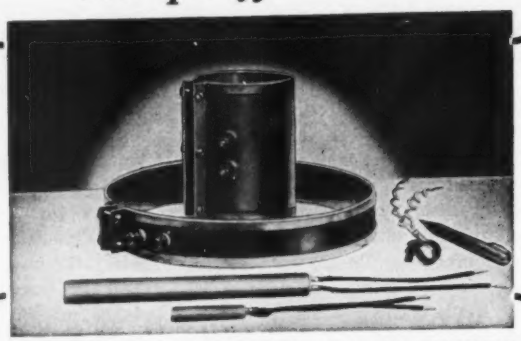

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vantages. First of all, its surface resistivity at temperatures near and above 300° F. is objectionably low, even though at room temperature it is excellent. Secondly, the resin catalyst combination now in use results in a slight thermoplastic tendency evidenced by a decrease in bond strength between the copper foil and the laminate at temperatures near 400° F. This makes necessary close temperature control when dip soldering or hand soldering these circuits. However, all in all, epoxy glass laminates have a promising future.

Silicone

Silicone-fibrous glass laminate has been used on a limited scale. The primary reason for its use has been its low dielectric loss factor. Printed inductances and certain types of television tuner parts have been made using silicone laminate simply because less expensive materials had too high dielectric losses for those specific applications. High temperature resistance might first appear to be a reason for using silicone laminate. This is not true, since epoxy resins are used in bonding the copper to the silicone glass laminate. Therefore, the composite material has only the temperature resistance of the epoxy resins. As yet no completely satisfactory system has been developed for bonding copper foil to silicone-glass laminates with a material which is equivalent in all properties to the silicone laminate itself. Therefore, for all reasons but dielectric loss, epoxy glass laminates can be substituted for silicone with somewhat of a cost saving.

Teflon

Teflon-fibrous glass laminate would be the ideal printed circuit material if it were not for its extremely high cost. Its very high temperature resistance, low moisture absorption, and extremely low dielectric losses make it a very desirable material to use. However, the only application of any magnitude to date where its cost has been justified is in printed circuit microwave technology. The Federal Telecommunications Lab. has worked out a system of using Teflon laminate in so-called microstrip high-frequency circuit elements. Teflon has been the only material which will operate satisfactorily at frequencies up to 8000 mc. in this particular system. Here the high cost of Teflon has not been an objectionable factor since a $2.00 printed circuit part might be replacing a $75.00 microwave plumbing fixture.

Many other materials have been considered and are in the process of evaluation for printed circuit use. A few of them are polyester glass mat, epoxy-Orlon and epoxy-Dacron, and diallyl phthalate combinations with glass cloth, Orlon, Dacron, and other fibers.

Future

What will the next few years prove up for printed circuitry? The opinions reported at the beginning of this article are rendered more valid by the discussion of applications and techniques which followed. For every job reported here a dozen are being kept under wraps. And each such job has as its foundation material plastics laminate materials. Where today a few thousand pounds of laminate are being used for printed circuits, there is no reason to doubt that thousands of tons will be used when present development programs bring results. — END

Irradiation

(*Continued from p. 101*)

trical applications show that the irradiated version may eventually be competitive with low cost standard flexible insulating materials.

For packaging, the combination of polyethylene's normal properties such as non-toxicity, flexibility, and low moisture vapor transfer, with its new found heat resistance, should bring vast opportunities in the food packaging field. Where the new material is not under load, it may be used in those areas where higher temperatures in food processing are encountered . . . which in turn may give rise to new concepts in package design.

Evaluation Program

Experimental films of irradiated polyethylene are currently being evaluated by a number of companies in the electrical and packaging fields, narrow film being the only form of the fabricated material offered to date. Other applications, which might benefit from the desirable properties of the material at higher operating temperatures or in contact with a broader range of solvents, are being studied and tests are being made on irradiated polyethylene housewares, bottles, and other molded shapes.

The Chemical Div. of General Electric at Pittsfield, Mass., is installing pilot-plant equipment in order to supply requests for samples and development quantities of irradiated polyethylene film. Initial product, application, and market development is being conducted on the film form first, because it lends itself to continuous irradiation and to maximum beam and machine utilization.

Pilot-plant equipment is also suitable for irradiation of small molded articles on which development work has been conducted. Investment in equipment for irradiation and in control and protective mechanisms will necessarily be quite high, and large volume operations will depend on achieving low per-unit processing costs.

The Editors wish to thank J. Rae Stirrat, Paul Goodwin, and Paul Gavaghan, Chemical Div., General Electric Co., for their cooperation in the preparation of this article.

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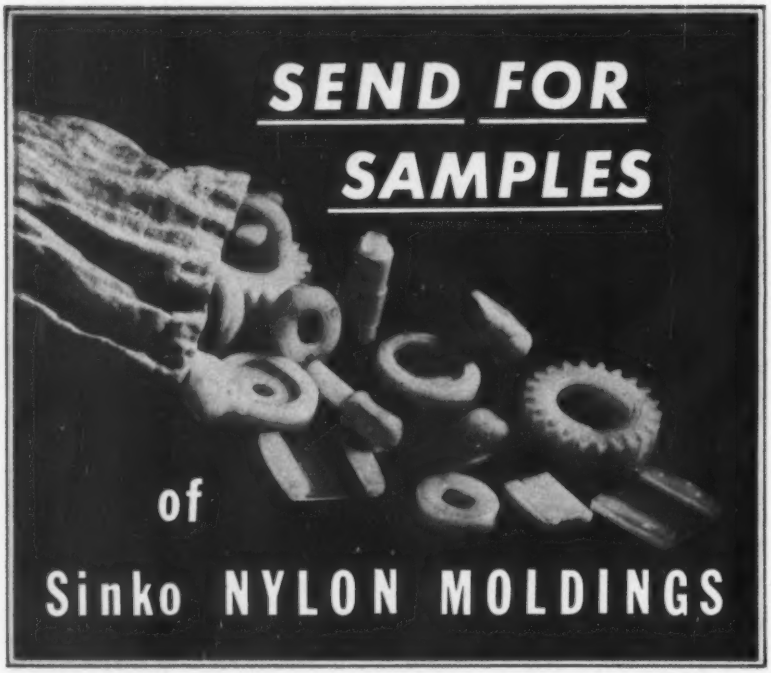

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Superpipe

(*Continued from p.* 105)

essary, and warranted costwise, a second outer tubing of extruded fluorocarbon can also be applied to the jacketed pipe.

The pipe has the same outstanding characteristics of corrosion-resistance and high tensile strength as the hose. It is completely inert to all acids, caustics, and organic solvents, and it performs creditably in temperatures that range from —100 to 500° F.

In addition, the rugged pipe has maximum resistance to thermal and physical shock and is extremely light in weight for its size and strength. A 1-in. pipe, for example, has a burst strength of 1600 p.s.i. and weighs 21 lb. per 100-ft. length; a 4-in. pipe has a burst strength of 400 p.s.i. and weighs only 80 lb. per 100-ft. length. Size range for the new pipe includes 1-, 1½-, 2-, 3-, and 4-in. diameters. Special sizes can also be produced where the requirements are large enough to warrant it.

The pipe can be easily cut and, with the aid of a portable heated flaring tool can be fitted right on the job. This tool operates on any 110-v. power source and consists of a heated forming die that is forced by means of a clamp into the end of the pipe.

Piping System

To make possible the installation of a complete piping system, a line of corrosionproof pipe fittings, including elbows, reducers, adapters, metal valves lined with fluorocarbon, and other parts machined from solid fluorocarbon stock are also available.

Although the pipe was developed specifically for difficult corrosion service applications in the chemical processing industries, it, like its sister hose product, is expected to have widespread use in other fields, as more and more engineers continue to turn to the fluorocarbons as the logical answer to many of the severe performance demands which are posed by modern industrial operations.

CREDITS: Fluoroflex-T R-500 hose and Fluoroflex-T laminated pipe are produced by Resistoflex Corp., Belleville, N. J., using Teflon supplied by E. I. du Pont de Nemours & Co., Inc.

Quick Copy

(*Continued from p. 104*)

it possible to form the parts in one piece, effected savings in the cost of production and assembly of the various components.

Despite the size of the unit—it measures 12 in. wide by 24 in. long by 6 in. high—the total weight is only 58 pounds. A comparable unit fabricated of metal would weigh at least 30 to 40 lb. more.

Each part—including all ridges, recesses, and depressions necessary for assembly—is formed in one piece in matched metal molds. In the 3/32 in. thick base of the unit, a raised motor platform is formed at one end. If the tray had been made of die-cast aluminum, as originally planned, it would have been necessary to build a separate metal motor mount—an expensive and time-consuming operation. The base is also formed with two deep recesses into which the two trays are inserted. A ridge around the perimeter of the base receives the edge of the cover for a snug fit when the unit is assembled.

The 1/8 in. thick cover is formed with a series of ribs running lengthwise across its center for added rigidity and improved appearance. Directly in the top center of the cover is a slight rectangular recess into which a separately formed name plate is cemented. It was decided to handle the name plate in this manner to avoid the necessity of scrapping the entire cover in the event that the trademark was slightly out of register. The two slots—one for receiving the photographic paper, the other for delivering the finished print—are machined into the cover after it has been formed.

A triangular pouring spout is formed into one end of each of the 3/16 in. thick trays.

To enhance the appearance of the unit, the cover is formed from grey sheet and the name plate, base, and two trays are formed from a contrasting black material with a lustrous finish.

Phenolic Rollers

The two rollers which are immersed in the trays of developer and stabilizer solutions are cast phenolic. The surface of each is cast

your product... clad in

STERLING SILVER

to capture sales!

Carvel Hall by BRIDELL

...The patented G.M.C. process of precious metal decoration on plastics

True proof of the irresistible sales appeal of G.M.C.-processed plastic products is only partly captured in the picture. Before-and-after case histories of the sales volume of a long series of plastics products give the real measure of the dollar-and-cents value of this exclusive decorating technique.

Consider these important factors:

- *the cost per unit for beautiful G.M.C. decoration is surprisingly modest*
- *the retail tag of G.M.C.-decorated products can often be doubled or trebled*
- *any plastic material can be decorated in precious metal*
- *there's literally no limit to the delicacy of pattern that can be applied by the G.M.C. process*

Investigate now! Ask us to decorate a sample of your product with a gleaming design in precious metal. Judge for yourself—better yet, ask your customers to tell you—the increased sales potential that results. Send your sample to us today—there's no obligation, of course.

G.M.C. PROCESS CORP.

No Connection with General Motors Corp.

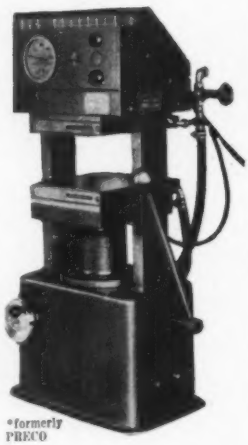
46 GREAT JONES STREET, NEW YORK, NEW YORK

your best bet
in a small
moulding press

P·H·I*

COMPACT·FAST
DEPENDABLE

- accurate temperature and pressure controls
- ram pressure up to 60 tons
- fast-action two stage pump
- choice of platens: 8"x8", 8¾"x12", 12"x12", 12"x18", 18"x18"
- special hot-cold laminating press
- modification to suit customer requirements



*formerly PRECO

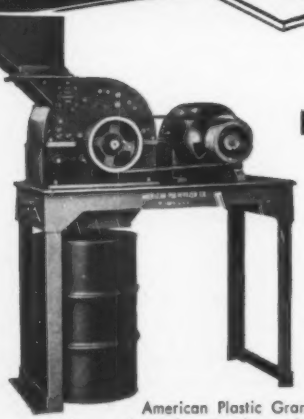
P-H-I Hydraulic Presses are used wherever specifications call for quick-acting pressure up to 60 tons and accurate temperature control to 600° F. May be operated individually by built-in hand pump, or in batteries from a central hydraulic system. *Write for detailed circular.*

PRESS

PASADENA HYDRAULICS, INC.
279 N. Hill Ave., Pasadena 4, California

PLASTIC MANUFACTURER REDUCES 200,000 LBS. OF PLASTIC SCRAP YEARLY with this

AMERICAN
ROTARY KNIFE
PLASTIC GRANULATOR



IN USE EVERY DAY . . .
6 DAYS A WEEK!

In the past year, this American KC-9 Rotary Knife Plastic Granulator, installed at a large St. Louis plastic molding company, has regranulated over 200,000 pounds of plastic scrap to a homogenous granulation . . . at a rate of up to 1500 lbs. per day. (Short scrap is being run through at an average of 300 lbs. per hour.)

American Plastic Granulators—available in two sizes, 9x9 and 9x12—are built for the heavy-duty demands of constant, tough usage. Size, shape, or kind of plastic is no problem for this sturdy machine. The clean, shearing action of the adjustable rotary cutter blades of fine tool steel, provide fast, once-through regranulation.

Write for your copy of "GRINDING PLASTIC SCRAP PROFITABLY"

American PULVERIZER COMPANY
Originators and Manufacturers of Ring Crushers and Pulverizers
1117 Macklind Ave. St. Louis 10, Mo.

with a knurled pattern that prevents the paper from wrinkling.

First step in the production of the rollers is to die-cast an aluminum model incorporating the knurled pattern. A flexible vinyl plastisol mold is then made from the aluminum model and the liquid phenolic poured into the mold. After the roller has cured, the flexible mold is stripped off.

A series of grooves is then machined around each of the rollers to accommodate stripper blades which prevent the wet photographic paper from sticking to the surface. Holes are then machined into the ends of each roller and metal shafts are press-fitted into position.

The rollers are turned by the motor through a rugged, corrosion-resistant molded nylon gear train which is exceptionally quiet in operation.

The Future

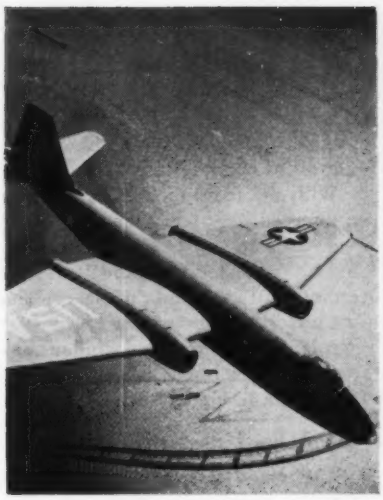
As business activities increase in tempo, the value of the photo copier as a practical and economical method for reproducing reports, letters, and other materials grows in importance. Moreover, the lightweight models which plastics have made possible have opened new possibilities for the use of the units by researchers, librarians, archivists, and others.

The day is foreseen when photo copiers will be as standard a fixture in the modern office or library as typewriters. When such a day arrives—and it is certainly within the realm of possibility—photo copiers will rank as one of the biggest and most profitable markets for plastics in the entire field of business machines.

CREDITS: Vinyl cushion for Contoura photo copier fabricated by Pioneer Valley Plastics Co., Chicopee, Mass., using Krene vinyl sheet supplied by Bakelite Co.

Reinforced plastics box for Constat dry-processor molded by Gull Products, Inc., Deep River, Conn., using Vibrin polyester resin supplied by Naugatuck Chemical Div. of U. S. Rubber Co.; phenolic laminate for end plates supplied by Spaulding Fibre Co., Inc., Tonawanda, N. Y.; polyethylene bottle supplied by Plax Corp., West Hartford, Conn.; vinyl carry-all fabricated by Lifton Mfg. Co., New York, N. Y.

Housing, base, and trays for Anken processor formed by Product Engineering Laboratories Co., Inc., Newark, N. J., using Boltaron copolymer sheet supplied by The Bolta Co., Lawrence, Mass.; phenolic rollers cast by Applied Resins Corp., Newark, N. J.



How Flexible prescribed the
"UNDERWEAR"
for the
B-57 Night Intruder

Big, rangy B-57 Night Intruders are stretching out in space in insulating "underwear" tailored to order in Georgia. Here's the story:

We received a call at 4 o'clock on a Monday afternoon from one of our clients who wanted to bid on a contract involving a fiber glass cloth impregnated and coated on both sides with a vinyl material. He needed a compound that was *fireproof*, had low temperature *flexibility*, was *mildew, gasoline,* and *oil* resistant. The finished cloth had to be *non-porus* and *tack free* to prevent easy soiling. The production *price* had to be right, and he needed a sample to submit in 72 hours.

Flexible went to work.

Two days later, our customer had received a compound meeting all of the requirements. He got the contract.

If you have a problem that needs the kind of fast *flexible* service we offer . . . call or write us. Give us your specifications and we'll help you formulate the answer in record time.

LOOKING SOUTH? There's space to expand down here. The labor supply is good, living conditions are superb, and our services are right next door by train or plane.

FLEXIBLE
Products
P.O. Box 306, Marietta, Georgia

Plastisols • Organosols • Latex • Slush Molding and Dipping of Plastisols and Latex • Custom Silk Screening and Heat-Sealing of Vinyl Film • Southern Reps. for Harte & Co., Mfgs. of "Wataseal" Film & Sheeting

Outerwear

(*Continued from p. 108*)

hunting coats, skirts, snow suits, and millinery.

Because of the low price of vinyl outerwear material, many of the accessories and garments which were once thought impractical to manufacture are now in production. A full length trench coat, for example, which would have been prohibitive in cost if fabricated of natural hides, is now being made of vinyl outerwear material and marketed at popular prices.

One step even further is the recent announcement by Bolta Products Sales, Inc., that Boltaflex Outerwear will be made available as yard goods. Since the material can be sewn on any commercial home sewing machine with a walking foot attachment, it can be used by the homemaker in creating her own garments.

Quality Products

There is, however, one blot on the rosy picture. As the number of manufacturers of vinyl outerwear material continues to increase, competition begins to tighten. It is felt by many in the industry that meeting such competition may lead to the production of vinyl outerwear materials lower in quality than those on the market today. Consumers in the past few months have come to expect a durable, long-wearing garment—quality at a low price. Anything that does not come up to their expectations will only do damage to a potentially very promising market.

As protection against the possibility of such a situation in the future, leaders in the industry feel that standards should be set. According to these men, such standards should specify the thickness of the vinyl sheet, flexibility of the garment at low temperatures, proper ventilation of the garment so as to prevent condensation, and the proper backing fabric to be used for the particular end product being made.

Properly formulated, properly manufactured, properly tailored, and properly merchandised, the vinyl outerwear materials seem certain of securing for themselves the large share of a rich market which they deserve. — END

FOR THE VINYL RESIN COMPOUNDER

Better Control of Migration and Processing

by basing plasticizer composition on

STAFLEX® KA

A complex phthalate combining the advantages of polymeric and monomeric plasticizers.

PROPERTIES

Color	50 APHA
Viscosity, cps. at 0°C	193,000
21°C	3,800
70°C	74
Cloud Point	Below –92°F
Specific Gravity, 30/30°C	1.04
Refractive Index, 30°C	1.498

Graded EXCELLENT for

- Solvent action and compatibility.
- Processing and light stability.
- Diffusion, heat, water and soap resistance.
- Electrical properties.

Some suggested applications: Unsupported vinyl film for upholstery, luggage, wall covering. Vinyl floor and counter top covering. Organosol and plastisol coatings. Plastisol slush molding compounds. Vinyl sponge. Pigment grinding medium.

Available in Drums and Tanks

Write for STAFLEX KA Technical Bulletin and Samples.

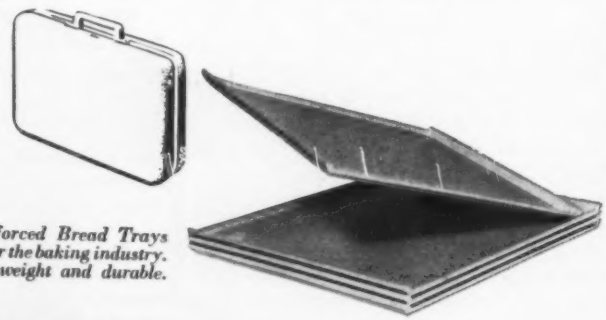
DEECY PRODUCTS CO.
PLASTICIZERS STABILIZERS
120 Potter St., Cambridge 42, Mass.

Shaped for You FOREVER

by FABRICON

Does your product need light weight, strength, ease of cleaning, brilliant molded-in colors, corrosion resistance, ability to withstand temperature extremes, choice of textures? Custom molded "Fabricon" gives you all this, and much more! When you bring your custom molding problems to Fabricon you take advantage of extensive background in research, product design, tooling and production. Regardless of shape of the molding you require, we can produce it in beautiful, durable "Fabricon"—a fiberglass-reinforced plastic.

Send details of your problem to Fabricon today. There is no obligation, of course.



Fiberglass-reinforced Bread Trays custom molded for the baking industry. Trays are light weight and durable.

FABRICON PRODUCTS, INC.
Plastics Division

1721 West Pleasant Avenue, River Rouge 18, Michigan
Manufacturing Plants—River Rouge, Los Angeles

New Material

(*Continued from p.* 111)

the left half of the viewer, an arrangement which facilitates changing bulbs or batteries.

With the parts molded of the new reinforced styrene material, the viewer is so sturdy that it has been hurled repeatedly against a concrete wall without damage. The manufacturer is thus assured that accidental dropping and similar mishaps will not break the viewer case or impair its operation.

Blend Used

The material used is of the externally lubricated type for improved flow out of the hopper, better heat transfer, and easier mold release. It is not used in its original form by the molder, but is first combined with general purpose heat-resistant styrene by tumbling, to obtain a blend having the desired properties and to lower the final material cost. Two parts of the heat-resistant styrene, in the desired color (black, maroon, or blue) are combined with one part of the glass-filled material, yielding a blend containing approximately 89% styrene and 11% glass fibers. In the finished parts, this material has a non-glossy, easy-to-grip surface and a slightly mottled appearance due to the presence of the glass fibers.

According to the molder, no production difficulties were encountered in switching over from medium impact styrene to glass-reinforced styrene for this application. No mold modifications were required and the cycle—approximately 60 seconds—was not altered. The job is run on a fairly extended cycle to insure maximum dimensional stability in the parts for a close fit between the halves of the case and to help eliminate sink marks opposite ribs and other thick internal sections. No shrink fixtures are used. The die is run somewhat cooler than for general purpose styrene and the plasticizing cylinder hotter, 430° F. on the front of the cylinder and 450° F. on the rear. A high temperature maintained at the nozzle promotes maximum flow of the fibrous reinforcements and filling of the mold.

The molding cycle includes approximately 15 seconds with ram

Rheemcote Poster Drums

Give Sales Producing "Family Identification"

to *new* CALIFORNIA OIL COMPANY Product

To introduce its *new* RPM 10-30 Special Motor Oil, The California Oil Company supplemented usual types of advertising with a colorful display designed to help win quick public recognition and acceptance for this new product.

An attractive, new four-color package design was developed. This design is featured on all RPM 10-30 packages from one-quart cans to 55-gallon drums.

This "family" of packages displayed in pyramid form at thousands of service stations throughout the East has helped California Oil quickly establish recognition and acceptance for this new motor oil.

Reproduction on large containers of the same design that appears on small packages is made possible by the exclusive Rheemcote lithograph process with which any design can be reproduced on drums up to 55-gallons in capacity.

You can use this powerful new advertising medium effectively. We will be glad to discuss the matter with you, or send you a colorful booklet which describes the sales possibilities of this important new medium.

Sell as you ship with Rheemcote Drums

RHEEM MANUFACTURING COMPANY

World's Largest Manufacturer of Steel Shipping Containers

RICHMOND, CALIFORNIA • SOUTH GATE, CALIFORNIA • HOUSTON, TEXAS • CHICAGO, ILLINOIS
NEW YORK, NEW YORK • NEW ORLEANS, LOUISIANA • LINDEN, NEW JERSEY • SPARROWS POINT, MARYLAND

NO MORE FLASH FIRE DANGER!

Liberty-Dawson Fuser-Embosser for plastisol and organisol supported films

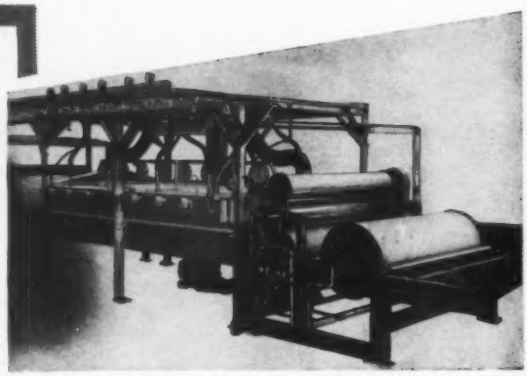


Photo courtesy H. M. Sawyer & Co., Coated Fabrics Div., Watertown, Mass.

Fuses and polishes or embosses in a single pass

The Dawson Vapo-Fuser* fuses plastic-coated upholstery fabrics and other supported plastisol and organisol webs with super-heated steam and a powerful suction system, thus banishing all danger of flash fires. The Vapo-Fuser is fed direct from the curing oven and attaches to a Liberty Embosser-Polisher which gives the web a high polish, a rich matte finish, or any desired embossed effect.

The entire set-up, in widths from 39" to 84", is designed for complete safety. Details supplied on request. LIBERTY MACHINE CO., INC., 275 Fourth Avenue, Paterson 4, New Jersey.

*patented

LIBERTY MACHINE CO., INC.

Write for your copy of our latest catalog.

Thermoplastics Pipe and Fittings Chart

copies still available!

In response to unprecedented interest in the subject, we have prepared reprints of the wall-size (17½" x 37") Thermoplastics Pipe and Fittings Chart which was included with the March, 1954, issue of MODERN PLASTICS.

This authoratative chart is indispensible for any company using or planning to use thermoplastics pipe and fittings. It lists and describes the output of 54 major pipe producers.

Once the supply is exhausted, no further copies will be available. Prices are as follows . . .

First 25 copies (1 to 25) . . . $1.00 each
Second 25 copies (26 to 50) . . .60 each
All additional copies . . . . . .50 each

INDUSTRIAL MAGAZINE SERVICE, INC.
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NEW YORK 22, NEW YORK

Please send me . . . . . copies of Modern Plastics' Thermoplastics Pipe and Fittings Chart.

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MAIL COUPON NOW

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forward, 4½ seconds on the booster, and 40 seconds on clamp pressure. The gating of the two larger parts is of square section, with rounded corners, and is relatively small, though not of the pin-point variety. Restricted gating is used on the oval lens mounting ring. No difficulty has been experienced in this operation with abrasion of the die or the nozzle.

Prior to assembly of the viewer, the cavity shaped section adjacent to the bulb is sprayed with a quick drying white lacquer for increased reflection. The glass lens is cemented within the mounting ring and the latter, in turn, cemented in place in a groove molded in the left side of the case. The sheet brass circuits are mounted in the case and secured by force-fits and heat swaging the plastic material at several points. The light diffuser, a rectangular piece of 0.062-in. white Plexiglas, is slipped into molded grooves and spot cemented.

Before the two halves of the case are combined, the film carrier is placed in position and the bulb and batteries installed. Then the right and left sides of the case are brought together and secured with the removable assembly bolt. Each viewer then receives final inspection and testing before being boxed for shipment.

Desired Properties

So we have three civilian applications of the new material originally desired because of the technical likelihood of higher impact strength, and while the moldings described above have impact strengths in the range of high impact styrene alloys, in no case was impact strength the main reason for use. The magnetic tape reels are made of glass reinforced styrene because of its stability and lack of shrink. The heater fans take advantage of its heat resistance. The viewers employ its dimensional stability, its heat resistance, and its strength.

The old bugaboos of mold abrasion, nozzle wear, and lack of return on scrap have in these jobs been laid completely to rest. The economics of the compound has been most satisfactory in these applications. Increased interest from injection molders and end users may be expected.—END

AGILENE

(POLYETHYLENE)
for ULTIMATE
CORROSION RESISTANCE

BY THE AGILE HOT GAS WELDING, FLAME SPRAYING, and FLOC-COATING METHODS

X-RAY TESTED FOR QUALITY CONTROL

For Hot Gas Thermo-Plastic Welding (electrically operated 110 volt gun) complete with 15 feet each inert gas or air hose, rubber covered flexible electric cord. Ask for Bulletin "Hot Gas Welding."

AGILENE SHEET

Largest sheets available! They range in size from 1/16" to 1" in thickness and the over all size is 48" x 72". Agilene sheets are molded from virgin Polyethylene resin, natural or black pigmented, and are free from air inclusions.

AGILENE ROD

Largest sizes available! Standard diameter ranges from 1/2" to 3" and standard lengths from 12 to 60 inches. Molded from virgin Polyethylene resin, natural or black pigmented.

AGILENE BLOCK

Largest sizes available! Standard dimensions range from 12" x 12" x 1" to 12" x 12" x 4" molded from virgin Polyethylene resin, natural or black pigmented. Larger sizes also available.

MOLDINGS

Largest sizes available! Up to 1,000 pounds.

SEND FOR COMPLETE LITERATURE

AGILENE

American Agile Corporation

Plant and General Offices
5461 Dunham Rd., Maple Heights, Ohio
Mailing Address, P. O. Box 168 • Bedford, Ohio
DEPT. C-2

Polyester-Glass

(*Continued from p. 135*)

mixed, and there was no evidence of any appreciable incidence of fiber breakage in the compound.

A quantity of compound was made using each of the three methods described above. The hand mixed material and the sigma blade mixed material contained 20% glass fibers by weight. The Brenner cutter compound contained 30% glass. These materials were tested for flexural strength and Izod impact strength and the results were analyzed statistically. These results are presented in Figs. 18 and 19. By reference to these charts it can be readily seen that the hand mixed compound had high average strength, but was non-uniform. This is particularly noticeable in comparing the Flexural Strength 95% Confidence Limit with the Average Flexural Strength. The material produced using the Brenner cutter had the highest strength of the materials tested here and it too was quite variable. The compound mixed with the sigma blade mixer was found to have the lowest strength although it was more uniform.

Conclusions

Glass reinforced polyester resin molding compounds exhibit considerable variation in physical properties. Because these materials can be made and molded with relative ease, sufficient study and care have not been provided in many instances to produce uniformly strong molded parts. Considerable skill is required to combine the proper filler and resin in a suitable manner with glass to produce a compound with good flow characteristics and molding properties. The physical form of the compound can be the difference between a good commercial material and one that it is impossible to mold properly.

A wider acceptance of glass polyester molding compounds for upgrading small industrial molded parts depends on the proper utilization of the inherent high strength of the glass reinforcing material. This can only be accomplished by using an economical molding procedure that will result in maximum production of a product which is uniformly strong.—END

AGILIDE

(NON-PLASTICIZED POLYVINYL CHLORIDE)
for ULTIMATE
CORROSION RESISTANCE

BY THE AGILE HOT GAS WELDING TECHNIQUE

X-RAY TESTED FOR QUALITY CONTROL

● Agilide is an outstanding construction material for use as a corrosion barrier. It is easy to handle and has very successfully replaced metal alloys, which in time succumb to the attacks of corrosion.

AGILIDE SHEET

Largest sizes available! Thicknesses range from 1/16" to 1" and the overall size is 48" x 72" and 108". These sheets may be cut to size.

AGILIDE ROD

Largest sizes available! Diameters from 1/4" to 1". Standard lengths are 10' 0". May be cut to any length desired.

AGILIDE BLOCK

Largest sizes available! Dimensions from 12" x 12" x 1" to 12" x 12" x 4".

SEND FOR COMPLETE LITERATURE TODAY!!!

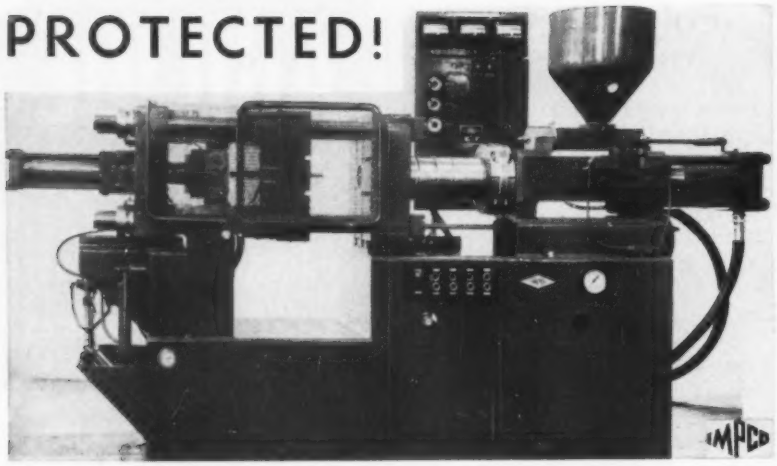
ACKNOWLEDGED *Pioneers* IN THE WELDING OF STRUCTURAL PLASTICS

AGILIDE

American Agile Corporation

Plant and General Offices
5461 Dunham Rd., Maple Heights, Ohio
Mailing Address, P. O. Box 168 • Bedford, Ohio
DEPT. C-2

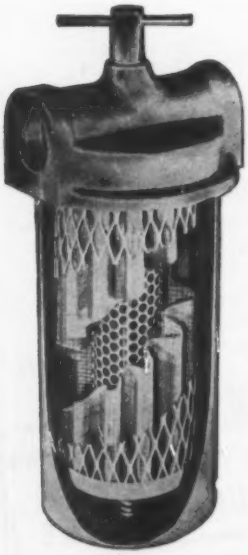
PROTECTED!



IMPCO HA4-175 4 to 6 Oz. Plastic Molding Machine. Marvel Synclinal Filters protect the hydraulic systems in Impco's complete line of molding machinery, and are installed as standard equipment. Photo courtesy Improved Paper Machinery Corporation, Nashua, New Hampshire.

with MARVEL SYNCLINAL FILTERS

Consistently, more and more manufacturers of hydraulically actuated and other low pressure liquid circulating equipment, are installing Marvel Synclinal Filters to keep the systems free of damaging particles. They want users of their machines to get MAXIMUM PRODUCTIVE OPERATION AT MINIMUM MAINTENANCE "DOWN-TIME."



LINE TYPE
(Cutaway)

FACTS NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning:

OVER 400 ORIGINAL EQUIPMENT MANUFACTURERS MAKE MARVEL SYNCLINAL FILTERS THEIR CHOICE

For Dependable Protection on All Hydraulic and Low Pressure Liquid Circulating Systems

SUMP TYPE
(Cutaway)

Marvels Synclinal Design provides that all-important balance between maximum *ACTIVE* filtering area and sufficient storage space for filtered out particles. Thus longer periods of productive operation are obtained before filter maintenance is necessary. Marvel Synclinal Filters are constructed so that when service is necessary, both sump and line type may be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates efficiently in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available in sump and line types, in capacities from 5 to 100 g.p.m. Choice of monel mesh sizes from coarse 30 to very fine 200.

IMMEDIATE DELIVERY

Marvel not only delivers a top grade filter in both quality and performance but delivers IMMEDIATELY. If desired, shipments are made same day orders are received.

MARVEL ENGINEERING COMPANY MP-4
625 W. Jackson Blvd., Chicago 6, Illinois

Without obligation, please send me complete data on Marvel Synclinal Filters as follows—
Catalog #106 for Oil Filters
Catalog #300 for Water Filters

Name .....
Company .....
Address .....
City ..... State .....

WATER FILTERS

In response to the great demand, we have adapted both our sump and line models for use in all water filtering applications. No changes have been made in the basic synclinal design.

MARVEL Engineering Co.
625 W. Jackson Blvd., Chicago 6, Ill.
Phone: Franklin 2-4431

Polyurethane

(*Continued from p. 146*)

attacked by Breslow and the Hercules Powder Co. on the basis of employing mixtures of a di-functional and a tri-functional diisocyanate (134). Compositions used for these purposes in Germany are discussed in the previously quoted paper by A. Hochtlen (9, p. 309).

A basic application of diisocyanates is in the improvement of drying oils by addition of small amounts of diisocyanates (118,129). Castor oil yields solid resins due to its di-functional nature (117,121,125). The success of the styrenated alkyd has overshadowed the work with diisocyanates in this direction. Yet these two processes by no means overlap and may supplement each other. The diisocyanate-modified drying oils have increased resistance to dilute acids and alkalies, and have reduced acid numbers, so that they do not tend to liver with basic pigments (115,116).

The urethane coatings are generally superior to rubber and polyvinyl chloride coatings in regard to tear strength, aging, and water resistance, and therefore seem likely to gain an increasing distribution, once the application methods have been streamlined further and mastered by a larger number of coating firms.

A large potential field is in can coatings and in protective coatings for magnesium, iron, and zinc, where the excellent adhesion, tenacity, and complete resistance and inertia to solvents, lard, greases, and flavors offer important advantages.

Pertinent also is a method for conversion of the hydrophilic groups in a polyester or other unsaturated alkyd resin to groups which are much less hydrophilic, while still obtaining a resin soluble in organic solvent This is achieved by reacting an unsaturated alkyd resin soluble in organic solvent with a 3 to 25% by weight primary isocyanate of the type exemplified by vinyl isocyanates, allyl benzyl isocyanates, and a large number of other unsaturated isocyanates (133).

Hydroxylated polyvinyl resins are treated with diisocyanates for better water resistance, toughness, and hardness (124). Alkyds modified with drying oil also improve in their water resistance when polyisocya-

nate is added, and their drying time is shortened (125). Polystyrene (137), glycol monoacrylate (131), polyvinyl chloride (120,136), polyamides (127), and other thermoplastics are also claimed in the patent literature as being improved by addition of organic diisocyanates.

Textile Applications

In textile applications the technique for application is based on an after-treatment with a volatile diamine to effect the cross-linkage, so that the coating can be applied in the normal manner, for example, with a doctor knife. Another procedure is to pre-treat the textile with a water solution of a diamine, and to apply the coating without any intermediate drying (153,154).

Diisocyanates reacted with cellulose derivatives form cross-linkages that enhance the resistance of the fibers to solvents, water, and heat (146,147,148,149,151). Treatment with diisocyanates or their reaction products are used to make other fibers more receptive to some dyes (150).

Summarizing, the urethane type resins have made substantial progress in the last few years. They are bound to find increasing application in foams and elastomers, and in all types of coatings where extreme adhesion, tenacity, good weathering, and complete inertia are important to a sufficient degree to warrant some extra care and arrangement for the application. The price should come down to the vinyl and polyester ranges, once volume is sufficient.

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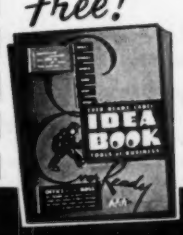

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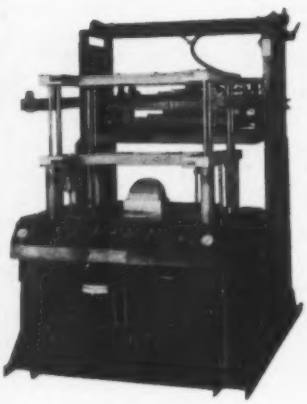

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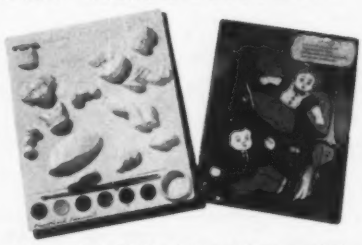

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Sales Picture

SALES volume of plastics materials for the first two months of 1954 (also March unless there is a sudden change) is in something of the same situation as the horse that finishes second or third in the Kentucky Derby. It isn't too bad, but it would have been nicer to win. At any rate, second or third is a lot better than ninth or tenth.

The plastics situation goes something like this: November and December 1953 volume was lower than most persons expected. For example, it was believed last October that polystyrene sales would average around 24 or 25 million lb. a month for the last quarter. Tariff Commission figures now published show that sales averaged around 23 million a month. And, strangely enough, November was a lower month than December for almost every plastic. No explanation is available, but such a performance is contrary to practically all past years.

Hardly anyone complained because the decline was expected. But the surprising trend has been that there was little or no pick-up over December 1953 volume in January or February 1954. Those two months generally show a decided increase over November and December of the year before. The start for 1954 is not auspicious. Yet molders are telling resin suppliers that they expect 1954 to be a good year—maybe close to 1953.

The toy industry may be symbolic of what is happening. In 1953, buying of both molding material and toys started early. There was little inventory left over from 1952 in either molders' shops or retail outlets. No one is in a hurry to buy in 1954 because 1953 closed with good inventories and no one is rushing to stock up for 1954.

In other words, the industry may be returning to its normal pattern when 60% of the business is done in the last six months. In 1953, the first half was far greater than the last half.

Good Year for Acetate: The cellulose acetate situation for molding powder, film, or sheet was not affected by the late 1953 slump. Volume slightly exceeded sales estimates for the last four months. Except for 1946 and 1950, it was the best year ever experienced by acetate and butyrate.

Tennessee-Eastman and Hercules each came out with a new Group III material—low-cost opaque and some translucent material at 41¢ a lb., which was 1¢ less than the former current price. Neither company had been offering Group III previously. Top extrusion grade acetate was still 50 cents. Translucent type, on last check, was 46 cents. There is reportedly also a large quantity of reprocessed acetate at prices considerably under any of the above on the market, but it doesn't show up in any of the Government's figures. Demand for this low-cost molding material is reported to be low.

Acetate molding material sales dropped off in January and February, but were expected to pick up in March when the toy people start buying again.

Cellulose nitrate had a remarkable year in 1953—the best in four years. Presumably it gained back markets in spectacle frames and shoe heel, toilet seat, and hamper coverings.

Urea and melamine had a good year, even though November and December were slightly under sales forecasts. Melamine dishware was probably the chief factor in the year's improved showing.

Phenolic molding powder sales averaged almost 16 million lb. a month in the last quarter but dropped from 17.6 million lb. in September to 13.1 million lb. in December. January and February are reported to be only fair. The decline in television and appliance production was almost certain to show up eventually in phenolic sales which were at an all-time high in 1953, despite comparatively low months in November and December.

The over-all vinyl chloride industry suffered a rather severe decline in November, with December showing good improvement. January was fair, but sales started to fall off again in late February, probably due in large part to the decline in automobile production, where vinyl upholstery has become particularly important. The vinyl film market is still slow with a chaotic price structure.

Under-Ocean Polyethylene

POLYETHYLENE is joining the fishes in ever-increasing quantities. And it is expected to have a much longer life than fishes; so far as anyone knows now it seems to be practically indestructible when used as a cable cover in salt water.

Ever since World War II, the Armed Services have been using lots of polyethylene in submarine cable. It can be made repugnant to a type of marine worm that feasts on some other types of insulation; it is resistant to moisture and to most chemicals; and it is also resistant to fatigue, a property that is being investigated more and more carefully these days in all sorts of thermoplastics materials.

One of the greatest advantages of polyethylene for under-water cable covering is its light weight—a factor of incalculable importance in handling or laying cable.

One of the biggest civilian uses for polyethylene in ocean-going cable is in the 2000 mile long $35 million telephone cable now under construction between Newfoundland and Scotland. This cable, a joint operation of A. T. & T. Co. of the United States, Canadian Overseas Telecommunication Corp., and Britain's General Post Office, will take three years to complete. Between 3 and 3½ million lb. of polyethylene will be used and a large portion of the cable will be manufactured in England.

Latest announcement concerning polyethylene-coated marine cable is a 1700-mile link in the Italian cable from St. Vincent to Recife, Brazil, which was produced by manufactur-

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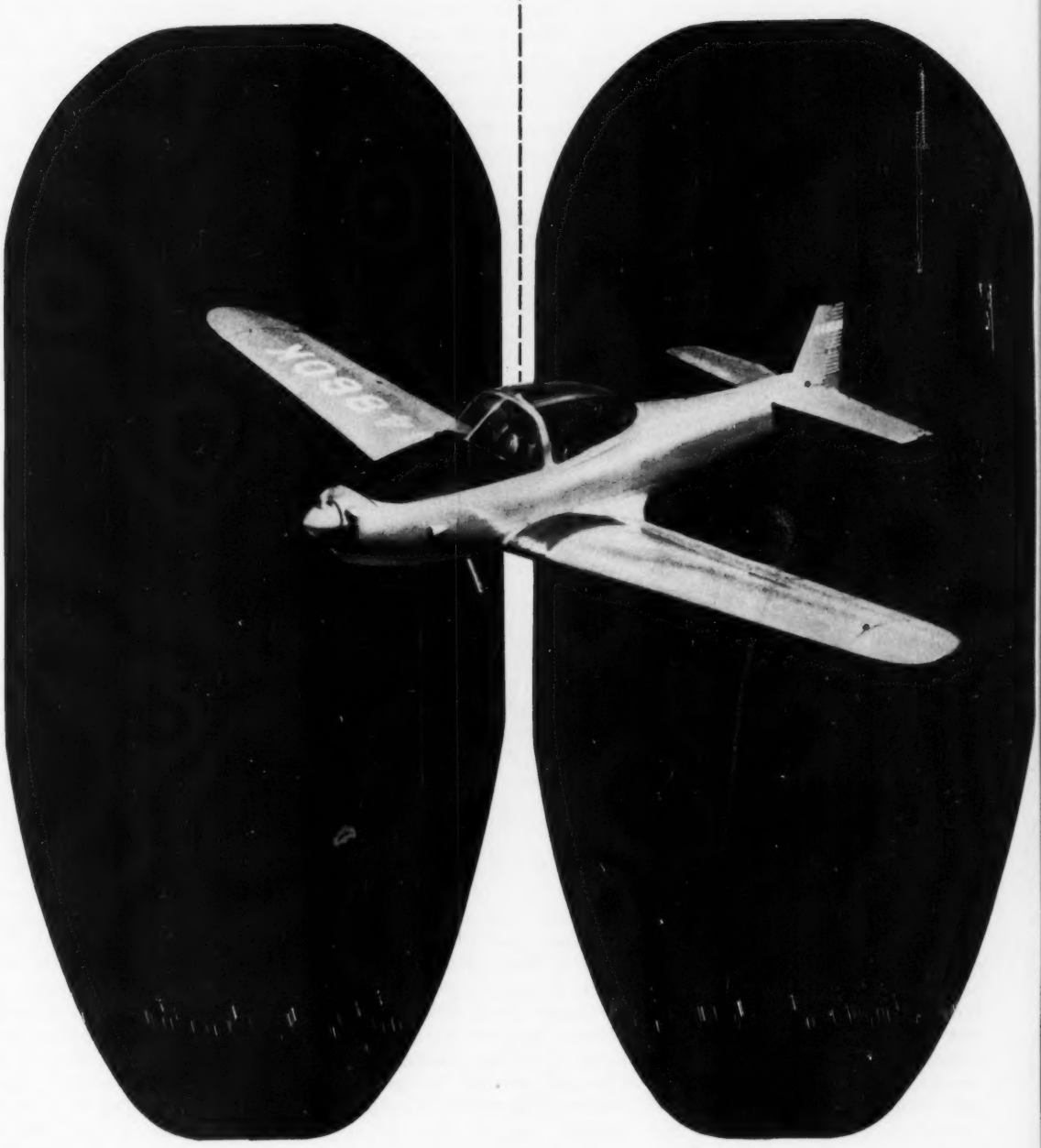

The Ryan side-by-side Model 72 trainer marks a notable forward step in both safety and effectiveness. The old tandem-type trainer may block the instructor's vision at critical moments. In the Model 72 both instructor and student have complete visibility in all directions, assured by the perfect optical properties of the Swedlow-produced canopy. That is why the airframe industry, when visibility is vital, unfailingly has recourse to Swedlow's specialized experience with transparent plastic glazing materials.

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ers in England, France, Germany, and Italy, mostly from Bakelite polyethylene. Published reports say this cable required 247 lb. per nautical mile or over 400,000 lb. of polyethylene.

Parapol S Available

FINAL arrangements have been made by the Market Development Div. of Enjay Co., Inc., 125 Broad St., Elizabeth 4, N.J., to make sizable quantities of Parapol S available for development work. This is the same material that was originally known as S Polymer. Semi-commercial quantities should be available by the middle of this year, in three different grades, S-40, S-50, and S-60, the numbers representing increasing styrene content.

One of the uses expected to develop is paper coating, as in multiple wall bags for packaging chemicals, since Parapol S is resistant to strong chemical attack, and in bags or containers for packaging materials which must be kept dry (or materials which must be kept wet) since Parapol S is an excellent barrier for water vapor and aqueous solutions. Parapol S is also an excellent barrier for a wide variety of gases. The plastic can be extruded into free film which is said to be more impervious to water vapor than cellophane and more transparent than polyethylene.

The new material is also compatible with most other plastics and resins. For example, blends can be made from Parapol S and GR-S, natural rubber, Butyl rubber, Vistanex, polyethylene, polystyrene, etc. It is also valuable for blending with wax or asphalt.

Small quantities of Parapol S were offered to the trade three or four years ago, but it had hardly become known to more than a few customers when Enjay took it off the market due to insufficient facilities to produce it.

Parapol S seems to be an ideal material for coating paper to use in the new Tetrapak package, a tetrahedron resin-coated paper package that nests compactly. The packages are made and loaded with fluid almost simultaneously on a novel machine now being produced in Sweden. Other resins can be used for coating the kraft paper used for the package, but Parapol S has so far proved particularly effective for packaging milk by the Tetrapak method because of its heat-sealing properties. It has a higher viscosity than many other plastics at heat-sealing temperature so that it does not become liquid and "run away" at the sealing contact point. This Tetrapak development is creating quite a stir in the packaging industry and is worthy of careful attention.

Most of the original production of Parapol S was used for film to make experimental liquid packages for pickles and other food products.

Vinyl Imports

CONSIDERABLE gossip in the industry is being built up concerning the amount of vinyl resin that is imported into the United States. A late check-up indicates that less than 1 million lb. of vinyl chloride resins were imported in the first half of 1953. Approximately 3,500,000 lb. were imported in the last half, with about 1,164,000 lb. in November. December was over 800,000 pounds. But January and February figures indicate that imports would be less than 500,000 lb. in each month.

These figures represent goods on the dock but not necessarily sold. Indeed, some of it may even be reexported. It is understood that most of these foreign resins have been used by film producers for blending with domestic resins. The biggest lot came from Italy. Some came from a resin plant in Belgium, but very little from Germany or England where vinyl is reported to be scarce; in England it is even on allocation.

The amount of vinyl resin exported from the United States in 1953 was at least 16 million lb. in quantities from a high of 3 million lb. in December to 600,000 in August. Over 10 million lb. of vinyl compound was shipped to foreign countries in addition to the solid resin mentioned here. Total production of solid vinyl resin in the United States in 1953 was probably between 350 and 355 million pounds.

It might be mentioned that almost 15 million lb. of vinyl film and sheeting were also exported from the United States in 1953.

Among the imports coming in late in 1953 were rolls of 10 and 20 mil thick patent vinyl sheeting from Germany, quoted at about 8½¢ a sq. foot. Patent vinyl of this quality sheeting is not ordinarily available from domestic sources in roll form—only in flat sheet. Other imports were vinyl shower curtains advertised as produced without the "regular" plasticizers used in the United States. They came from a German producer who reportedly claims that he buys his resin in the United States.

Polyethylene Molding

PROSPECTIVE availability of more polyethylene opens the door for much more experimentation by injection molders. Indications of what has been going on have been coming to notice ever since last July when many examples of what to expect in the future were on display at the Housewares Show in Atlantic City. At that time, kitchenwares, such as a 17-qt. pail, vacuum pitchers, and all sorts of refrigerator dishes were on prominent display.

The Chicago Housewares Show this winter indicated even farther progress. Among other notable items was a polyethylene lunch box made to look like metal. It was molded with round corners for easy cleaning, equipped with molded-in hinges, and had a dome for a thermos bottle. The large size lunch box for industrial use was furnished in black or gray, with either the bottom or hinges in red, and frosted white top for color appeal. A children's size will be made in red and white. The large size sells at retail for $2.49, the children's size for $1.98. It was produced in a mold formerly used for polystyrene. Polyethylene may be an ideal material for lunch boxes—it is resistant to oils and acids and can take abuse.

Other interesting polyethylene molded items at the show were an ice tray where water can be frozen to produce small chips that are smashed against each other to become "shaved" ice when the container is turned over by the user

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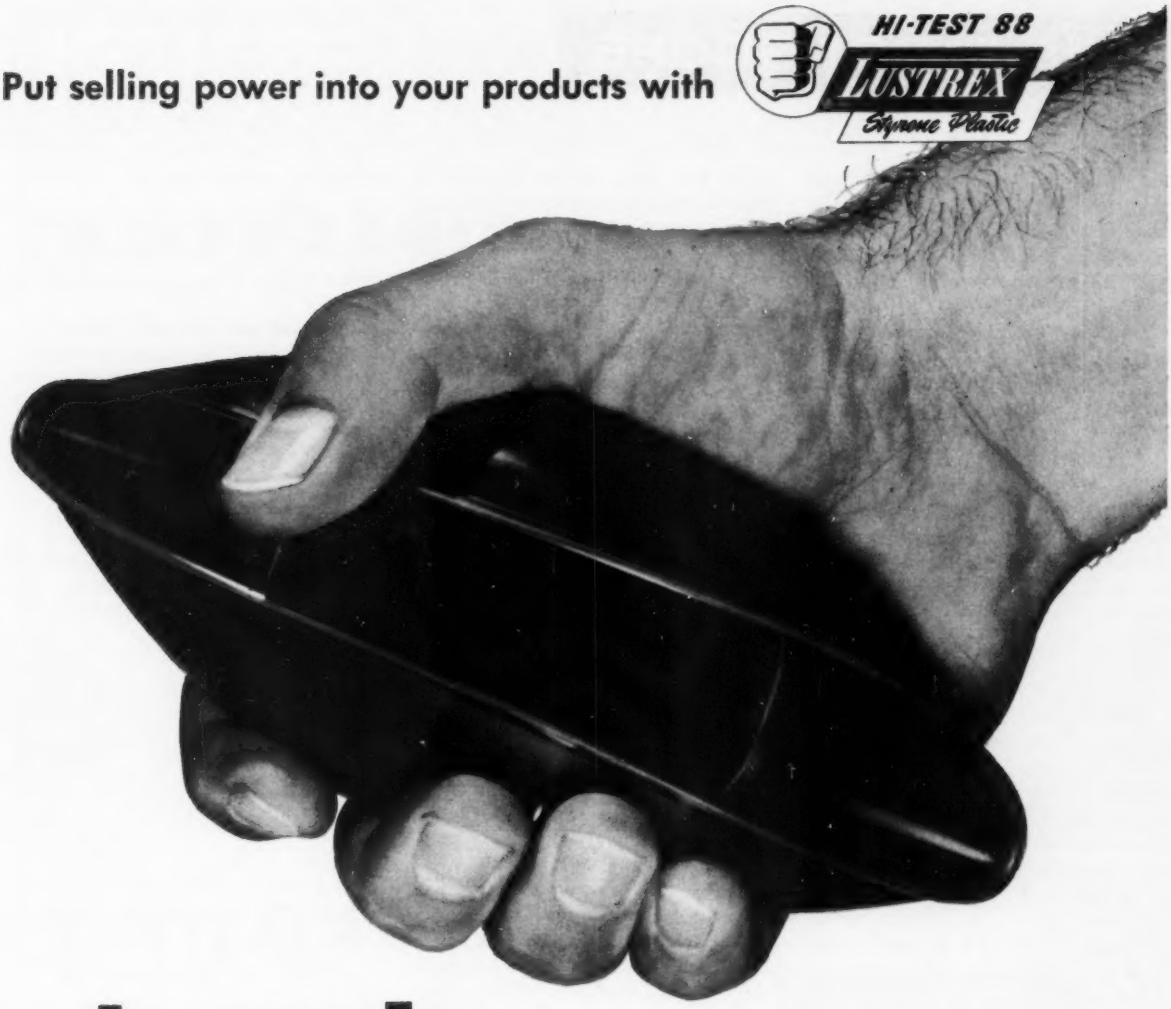

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and twisted vigorously to remove the ice. A polyethylene flashlight case was also on exhibit. Plastics have had a sad history in flashlights; perhaps polyethylene will overcome previous prejudices.

From another point of view, practically all the packages used by Colgate which require tops are now coming to market with polyethylene closures.

And from England comes a rather unusual use, but one that could involve considerable poundage volume. Our esteemed contemporary, *British Plastics*, is printing an item on a polyethylene molded "baby chamber pottie." It is not only indestructible and resistant to acids, "but it has a nice, warm feel" that any baby is likely to appreciate.

The variety of molded polyethylene pieces is beyond prognostication. It is even possible that this branch of the polyethylene industry, which up to now has accounted for less than one-third of total production, may grow in greater ratio than the more publicized film and electrical branches. Some 18 million or so pounds are thought to have been used for molding in 1953 in contrast to 39 or 40 million lb. used for film and 30 or 34 million lb. for electrical purposes.

Improved Polystyrene

A NEW formulation of general-purpose Styron developed by The Dow Chemical Co., Midland, Mich., is expected to open new markets for polystyrene because of the possibility of better control over the flow of plastic in the mold.

The new material, known as Styron 688, flows faster and more evenly throughout the mold. It is claimed by Dow that Styron 688 may be used advantageously in such applications as thin wall containers, vials and tubes, wall tile, back painted parts, large boxes and containers, egg crate and honeycomb sections, and brush backs. Extensive field tests show that in many instances the result is better parts, faster cycles, and fewer rejects.

The material, available in crystal, transparent, and opaque colors, follows the same price schedule as Dow's general-purpose polystyrene. A technical data bulletin giving properties, molding considerations, etc., is available from Dow's Plastics Technical Service.

Shell's Epon Plant

THE world's largest epoxy resin plant has been brought into production by Shell Chemical Corp. at Houston, Texas. The new facilities will triple the supply of Epon resins.

These resins were made available in 1947 and have had exceptionally good acceptance in the coatings and plastics field. Epon paints, for example, are being used by virtually all washing machine manufacturers because of their unusual resistance to alkalies and detergents. In the plastics field, Epons have been used in the casting and potting of electronic components and in the manufacture of printed circuits. Because of their adhesive qualities, they have found industrial application in joining metals, glass, and other materials.

As part of its expansion program, Shell is also opening a bis-phenol-A plant, which makes the new Epon unit independent of outside suppliers for this component of Epon resins. The manufacture of epichlorohydrin, the other chief component of these resins, was pioneered by Shell Chemical.

D.I.D.P.

COMMERCIAL production of diisodecyl phthalate (D.I.D.P.), a general-purpose low-volatile plasticizer for polyvinyl chloride has been announced by Monsanto Chemical Co.'s Organic Chemicals Div., St. Louis 4, Mo. A clear, oily liquid, D.I.D.P. is similar to di-2-ethylhexyl pthalate (D.O.P.) but with lower volatility characteristics. The new material is priced competitively with D.O.P. and will augment Monsanto's production and sales of D.O.P. and other vinyl plasticizers.

Monsanto spokesmen state that the volatility of compounded D.I.D.P. is less than one-half of the volatility of D.O.P. similarly formulated. According to the results of the standard S.P.I. volatility test, a six-day heat-aging period resulted in a 22% loss of D.O.P. compared with a loss of only 4.7% of D.I.D.P.

The new product is suggested as a polyvinyl chloride plasticizer where a general-purpose low-volatility plasticizer is desired, such as in the manufacture of upholstery sheeting, heavy-gage film, floor tile, wire insulating compound, and plastisols.

A technical bulletin which includes a table comparing the properties of polyvinyl chloride compounds plasticized with D.I.D.P. and D.O.P. is available from the Organic Chemicals Div.

Aluminum Pigment

ALUMINUM powder and D.O.P. plasticizer, compounded into a 50-50 mix for vinyl processors, has been put back on the market by Reynolds Metals Co. after an interruption in service caused by the shortage of aluminum two years ago. The "mix" is claimed to be much easier to handle than straight pigment powder because it is less hazardous and disperses into the compound with less trouble in milling.

Two grades are available—36 standard lining grade and 46 extra-fine grade. It is recommended particularly for vinyl film, garden hose, and welting, and is also used to give a metallic effect to transparent colors.

Dry Blend Vinyl

ANNOUNCEMENT of new resin, called Pliovic DB8OV, with plasticizer absorbing qualities so that it can be dry-blended with other ingredients in inexpensive mixing equipment has been made by The Goodyear Tire & Rubber Co., Akron, Ohio.

The product is reported to have good dry-blending properties because of resin particle size and shape. Liquid plasticizers are absorbed in such a manner that the mix is not wet but flows freely.

Quality Controlled Glass Mat

NEW requirements in mass production of reinforced plastics for materials with established engineering properties brings an announcement from Owens-Corning Fiberglas Corp., 598 Madison Ave., New York 22, N.Y., of the establishment of a new quality control system keyed to

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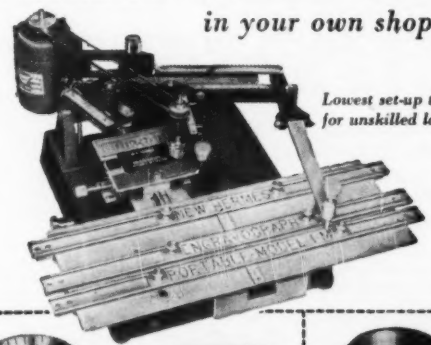

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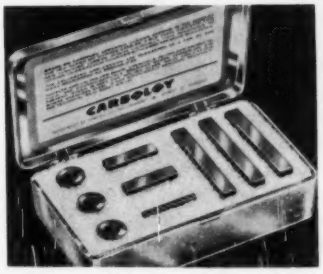

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fibrous glass mat production. The program involves three factors: a) refinements in product definition for various applications; b) new forms of quality control on the production line; and c) improvement of all standard materials according to this pattern.

The development was necessitated largely by the increase in press molding and larger pieces which require more accurate thickness control in molded parts.

Plastics Tools

THREE years ago, Wal-Mar Plastics, Inc., was formed to develop tooling equipment for the aircraft and automotive industries. The original plant in El Segundo, Calif., has now been moved to a new 10,000-sq. ft. plant in Torrance, Calif.

Among the new materials offered are the following: Toolaminate, an epoxy laminating resin designed for spotting models, fixtures, and drill jigs; Tooldie epoxy casting resin used for drop hammer die facings, stretch dies, and forming blocks; Toolglaze liquid parting spray which makes possible the quick preparation of models in pouring phenolic or epoxy tools; and Toolrezin, a low viscosity, high stability liquid phenolic casting resin primarily compounded for use in the tooling industry to provide non-shrink, warp-free tooling material.

Officers of the company are: Wallace deGeorge, president; Ritson Balling, plant superintendent; and Rex Brookhart, sales manager.

Light-Stable Polyesters

DESIGNED for laminates such as awnings, canopies, flat and corrugated sheeting for skylights, patios, porches, breezeways, greenhouses, and other outdoor applications, is a new light-stable polyester resin developed by the Marco Products Dept. of Celanese Corp. of America's Plastics Div., Linden, N.J.

The company claims that castings of the new resin retained 98% or more of their original light transmission following 1500-hr. exposure to Fadeometer tests. The resin, priced at 40¢ a lb., is supplied in liquid form which may be converted promptly to a solid state by application of moderate heat or at room temperature through use of a special catalyst system.

Plastics Principles

USE of the right plastics material for the right job is being promoted by the four main associations of the plastics industry by calling on all who produce plastic products to adhere to a set of principles which require the correct selection of plastic materials.

The new Statement of Principles of the Plastics Industry (reproduced on this page) was recently endorsed for their associations by William C. Foster, president of the Manufacturing Chemists' Association; John J. O'Connell, president of The Society of the Plastics Industry; John W. LaBelle, president of The Society of Plastics Engineers; and S. Ernest Kulp, president of the Plastics Coating and Film Association.

All companies affiliated with these associations will be asked to accept this statement of principles as a voluntary standard of individual conduct. The associations and their members will then urge all fabricators of plastic products to adopt these principles in their selection, purchase, and use of plastic materials.

All signatory organizations will be asked to display the statement in offices and factories, and to work actively and continuously to indoctrinate engineers, technicians, production men, sales representatives, and purchasing agents.

As one company official expressed it, the Statement of Principles will

Statement of

Principles

by the

Plastics Industry

PLASTIC materials challenge industry with new concepts of design, engineering, construction, processibility and usefulness.

The properties of plastic materials, when correctly used, open up great new areas of service to industry and the public.

Improper use can do irreparable damage to the plastics industry, to both manufacturers and processors of the materials.

Therefore, we as manufacturers and processors of plastic materials reaffirm our adherence to the principles upon which the healthy growth of a great industry depends and undertake to:

I. Understand thoroughly the properties and limitations of all plastic materials handled by us;

II. Apply the correct plastic materials to all industrial end uses, designing and engineering them for maximum value, performance and safety;

III. Use great care to select the correct plastic materials for all consumer items, designing and engineering them to insure value, satisfaction, safety and pleasure to all users;

IV. Sell plastic materials, and all industrial and consumer items made therefrom, on the merits of the materials, applications and design, and free of extravagant, insupportable claims.

All to the end that plastic materials already available, and others that may come, will bring to industry and public alike all the benefits, economies and satisfactions inherent in these versatile engineering and construction materials.

Endorsed by:

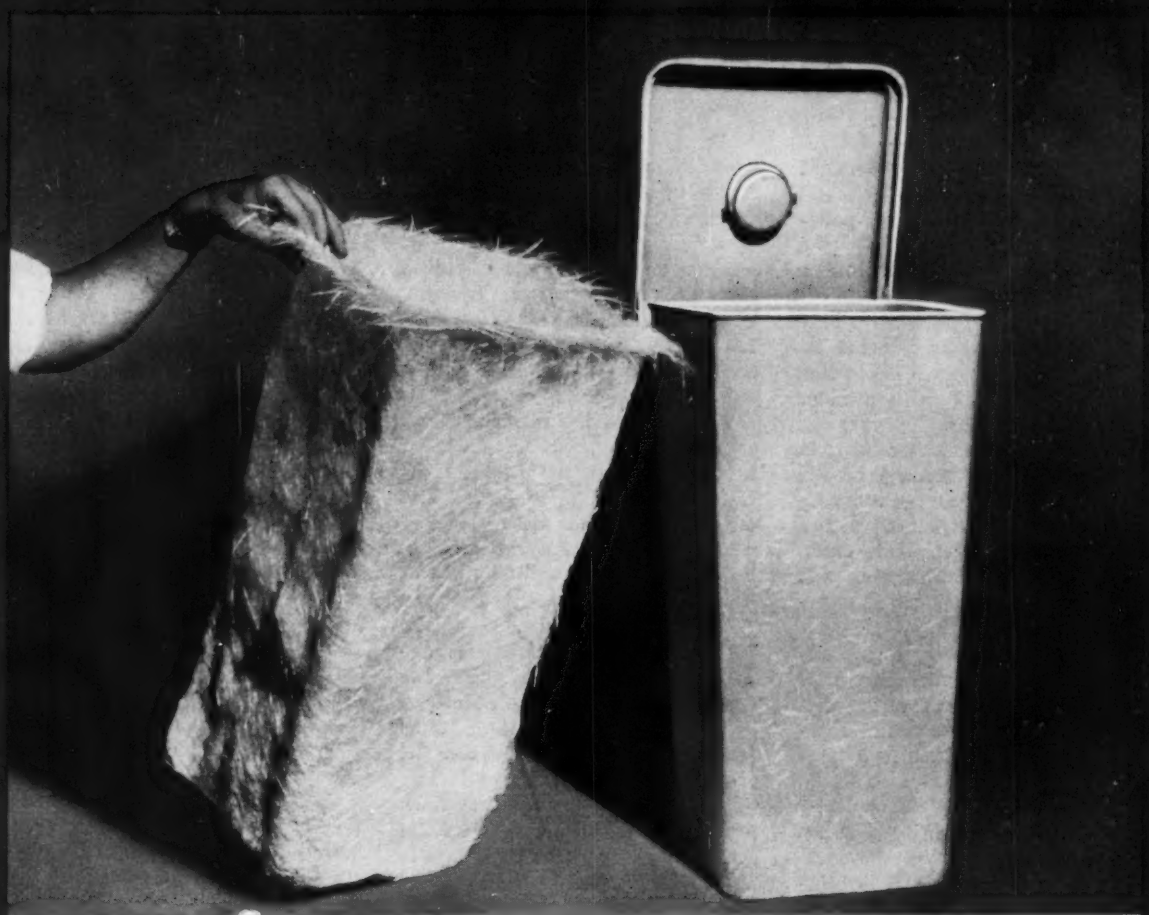
Manufacturing Chemists' Association, Inc. — William C. Foster, President

The Society of the Plastics Industry, Inc. — John J. O'Connell, President

The Society of Plastics Engineers, Inc. — John W. LaBelle, President

Plastic Coatings and Film Association — S. Ernest Kulp, President

Accepted: _____ _____ _____



WHY HOLIDAY PLASTICS USES **PARAPLEX** MOLDING RESINS

This diaper hamper, molded in one piece except for the lid, is one of a whole range of durable, attractive items produced by Holiday Plastics with the aid of Rohm & Haas PARAPLEX "P" resins. Holiday Plastics also chose PARAPLEX resins for such products as heat-resistant lamp shades; smooth, one-piece trowels; and rugged camera cases. PARAPLEX was preferred because:

PARAPLEX "P" resins are available in a number of grades, each compatible with all the others. They can be blended to obtain special properties. The resins can be infinitely diluted with monomeric styrene and other monomers.

PARAPLEX "P" resins are 100-percent reactive. They can be converted into solid, infusible products which are soft and flexible, or rigid and tough.

PARAPLEX "P" resins can be cured at either room or elevated temperatures. By proper catalyst selection, they can be adapted to a variety of production schedules. The resins are highly stable, both when catalyzed and uncatalyzed.

PARAPLEX is a trade-mark Reg. U.S. Pat. Off. and in principal foreign countries.

By making their diaper hamper of PARAPLEX resins and glass fibers, Holiday Plastics gave it light weight, high strength, and long life. The hamper won't dent. Colors won't come off even under the frequent steam-sterilization to which these hampers are subjected, because the colors go through and through. Cleaning is easy. The resins are unaffected by soap and water, common solvents, and many corrosive liquids.

Sound interesting? Then write us today and let us tell you more about the PARAPLEX resins.

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be a guide for companies to guard their own activities voluntarily and individually. No enforcing or policing action is contemplated by the association, the program being a wholly voluntary one.

The Principles presented here have been adopted as a theme for the National Plastics Exposition, which will be held June 7-10 under the auspices of S.P.I.

There are several major steps in this direction. The Society of the Plastics Industry has been setting up commercial quality standards as a general guide, and in some cases, hallmarks of quality. This group and the Manufacturing Chemists' Association are now revising a guide for designers and buyers of plastic products in retail outlets. A similar guide for buyers of plastic upholstery has been prepared by the Plastics Coating and Film Association. At Massachusetts Institute of Technology, M.C.A. is sponsoring fundamental research in engineering properties of plastics.

Qualified companies and associations desiring to subscribe to the Statement of Principles can arrange to do so by contacting any of the endorsing associations.

Cycolac

INTRODUCTION of a new high-impact styrene-type resin, called Cycolac, has been announced by Marbon Corp., 1926 W. Tenth Ave., Gary, Ind. It is claimed that this material is characterized by excellent impact resistance, high heat-distortion and low brittle-point temperatures, shrink-free calendering and extruding, bright colors, good resistance to chemicals, light weight, outstanding electrical properties, high gloss, and solubility in selected solvents for potential coatings applications. It can be solvent-welded or machined.

More Polyethylene

A SERIOUS error was made in the section on polyethylene which appeared in the annual review in the January 1954 issue of MODERN PLASTICS. The error was called to our attention by Imperial Chemical Industries Ltd. of England. They point out that we had listed their production as around 12 million lb. a year. This figure was grievously low.

The corrected version received from I.C.I. is as follows: "Imperial Chemical Industries Ltd. in England, the original producer, has installed capacity for making about 40 million lb. of polythene a year and plans have been prepared to increase the capacity considerably in the near future to satisfy not only all the United Kingdom markets, but also export markets in those countries where polyethylene plants have not been constructed."

Translucent Polyester

THREE new polyester resins—Laminac 4147, Laminac 4110, and Laminac 4111—have been developed by American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N.Y.

Laminac 4147, for the first time, permits the fabrication of translucent panels having both light stability and self-extinguishing properties. The self-extinguishing property is maintained even after long exposure at 150° F.

In the past, the only way to achieve self-extinguishing properties in reinforced plastic panels was to add to the resin a combination of a chlorine-containing compound and a material such as antimony oxide. However, use of these compounds caused the panels to discolor rapidly. Self-extinguishing properties are not permanent in the older system and decrease with storage.

Laminac 4147 is a styrene-base resin and can be used in much the same manner as typical non-self-extinguishing resins. Physical properties of the cured resin are comparable with standard polyester resins.

Laminac 4110 is a low-viscosity-type resin designed primarily for use in low-temperature curing applications. It is not affected by air exposure during its cure and the time which it takes to dry to a completely tack-free surface can be controlled through the percentage of catalyst utilized. Surfaces may be sanded or finished immediately after curing has been completed.

This new resin is particularly applicable where excellent surface cure and resistance to water are required in the end product, such as boats.

Laminac 4111 is a low-viscosity styrene monomer modified polyester resin and can be promoted and catalyzed for low temperature or atmospheric curing conditions.

The company claims that fibrous glass laminates made with Laminac 4111 are superior in strength retention properties to the conventional polyester resins when exposed to boiling water, boiling 10% mineral acids, and even boiling 10% caustic. However, this resin is not recommended for uses requiring highly alkaline resistance without prior testing against the actual conditions of exposure.

No Hyatt Award

NO Hyatt Award will be given this year, according to William Cruse, secretary of the John Wesley Hyatt Award Committee. The Award was established by Hercules Powder Co., Inc. in 1941 to honor John Wesley Hyatt, discoverer of nitrocellulose and father of the plastics industry.

Ethyl Cellulose Prices

THE first increase in the price of its ethyl cellulose flake in more than three years has been announced by Hercules Powder Co., Inc., Wilmington, Del.

The new basic price schedule per pound in single shipments is as follows: 23,000 lb. or over, 69¢; 10,000 to 22,999 lb., 70¢; 2000 to 9999 lb., 72¢; 60 to 1999 lb., 75¢; and under 60 lb., 81 cents.

Glass Companies Merge

FIBROUS glass manufacturing facilities as well as other assets of the Glasfloss Div. of Tilo Roofing Co., Inc. have been purchased by Pittsburgh Plate Glass Co. The assets include the manufacturing plant at Hicksville, N.Y., inventories on hand, patent rights, trademarks, and good will.

The Hicksville plant was built in 1946 and has approximately 200 employees. The Glasfloss plant employs a technology entirely different from that used at Pittsburgh Plate Glass Co.'s Shelbyville plant and produces

You can rely on Witco PLASTICIZERS

Characteristic of WITCO esters are their clarity, absence of color, and lack of odor. These physical properties in a plasticizer are important in many applications where the plastic end product is produced to meet special requirements.

Complete technical service is available to every user of these WITCO esters. Write today for technical data and/or samples of the esters in which you are interested.

Among the ester-plasticizers manufactured by WITCO are the following:

Butyl Oleate—technical and premium grades
Butyl Stearate—technical and cosmetic grades
Dibutyl Phthalate • **Dioctyl Phthalate**

WITCO CHEMICAL COMPANY

260 Madison Avenue, New York 16, N. Y.

Boston • Chicago • Cleveland • Akron • Houston • San Francisco • Los Angeles • London and Manchester, England.

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a much thicker fiber which is used in the manufacture of battery separators and air filters, products not previously produced by Pittsburgh Plate.

Epoxy Plasticizer

DEVELOPMENT of a new epoxy plasticizer which can improve the stability and permanence of vinyl formulations has been announced by Pittsburgh Coke & Chemical Co.'s Plasticizer Div., 1905 Grant Bldg., Pittsburgh 19, Pa.

Designated as Pittsburgh PX-800 Epoxy, it is a highly compatible polymeric type plasticizer recommended for use with vinyl resins and synthetic rubbers. Technicians claim that it offers definite advantages over ordinary plasticizers in permanence and volatility. The new plasticizer also has the distinct advantage of serving in vinyl compounds as a stabilizer to both heat and light. Its use can reduce the amount of metallic stabilizer that would ordinarily be required.

Vinyl for Extrusion

PLASTICS extruders can now obtain quick delivery of vinyl dry blend compounds in carload quantities or less, in any matched color, at claimed savings up to 12¢ a lb. from the Extrusion Div. of Auburn Button Works, Inc., Auburn, N. Y.

In processing the dry blends, temperatures ranging from 225 to 245° F. may be used, whereas conventional mixtures require temperatures from 300 to 350° F., approaching the thermal decomposition point of the material.

The vinyl dry blend mixtures are described in a 21-page brochure obtainable from the company.

Advertising Award

AN award of merit for its outstanding series of advertisements run in MODERN PLASTICS has been presented to Plastics Engineering Co., 1607 Geele Ave., Sheboygan, Wis.

The award, made by the Art Directors Club of Chicago, was based on the design of a complete unit in trade magazines. Institutional in nature, copy for the series of advertisements had been taken from the fables of Aesop with a modern parallel drawn to today's industrial application.

The advertisements were prepared by Kuttner & Kuttner, Inc., 646 N. Michigan Ave., Chicago 11, Ill.

Association Officers

AT THE annual meeting of the Proprietary Plastics Manufacturers Association, 5719 W. Chicago Ave., Chicago 51, Ill., these officers and directors were elected for 1954.

President: Richard A. Winter, Federal Tool Corp., Chicago 45, Ill.

Vice president: D. S. Poulton, Columbus Plastic Products, Inc., Columbus 4, Ohio.

Executive secretary: R. J. Robertson, 5719 W. Chicago Ave., Chicago 51, Ill.

Consulting Chemists

REPRINTS of the anniversary edition of Consulting Services 1953 are now available from Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N.Y., at $1.00 per copy.

The Association has re-appointed for the 26th time Robert T. Baldwin as executive secretary and assistant treasurer and A. B. Bowers as director of publicity and assistant executive secretary.

EXPANSION

Jamison Plastic Corp., 71 E. Sunrise Highway, Freeport, N. Y., has started construction of a plant to house all its operations on a 3½-acre site in North Bellmore, N. Y. The new building will provide 31,500 sq. ft. of space for all the expanded Jamison facilities, but provisions have been made for a possible expansion to 100,000 sq. feet.

Separate departments will house the executive offices, toolroom, engineering department, molding section, and painting and spraying division.

Dow Corning Corp., Midland, Mich., announces that its recently organized Canadian subsidiary, **Dow Corning Silicones, Ltd.** has moved into its new office and warehouse building on Tippet Rd., Wilson Heights, Toronto, Ont.

The Canadian company has taken over the sales, service, and warehousing operations, which since 1945 have been carried on by Fiberglas Canada Ltd. as Canadian distributors of Dow Corning products. The Fiberglas personnel which has been engaged in the sales of silicones has been taken over by the new company.

Robertshaw-Fulton Controls Co. has broken ground for a new 237,000 sq. ft. plant in Long Beach, Calif., to house its Grayson Controls Div. The division is presently located in Lynwood, Calif. Robertshaw-Fulton, manufacturer of temperature and pressure control devices, has seven manufacturing divisions from coast to coast.

John Waldron Corp., New Brunswick, N. J., has erected a new laboratory building which contains a complete webbing processing line, development machine shop, offices, engineering design facilities, and storage for the precision laboratory instruments used in measuring the performance of experimental machinery.

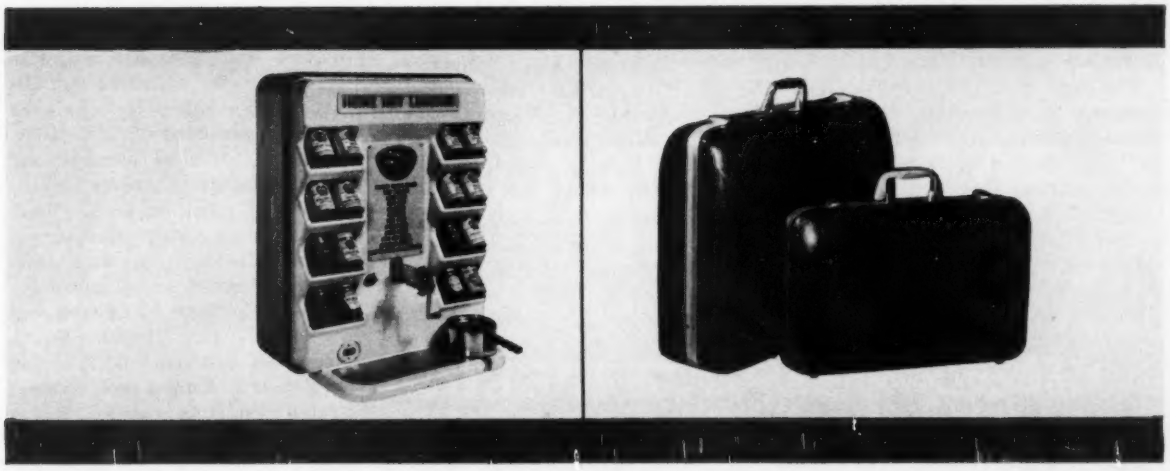
Equipment is designed to perform a variety of operations on webs of paper, plastics, textiles, and foil in widths up to 20 in. and at speeds from 5 to 2000 ft. per min., and higher in special cases.

Pilot plant equipment at Waldron is always available to prospective customers for use in product development and in determining the suitability of machinery to manufacturing or converting operations. Tests of one or two days duration can be scheduled by making advance reservations with the company. A nominal charge is made for tests.

Du Pont is building a new pigment colors research laboratory at its Newark, N. J., pigments plant. The company states that the laboratory will be used for scientific studies leading to the development of new colors for paint, lacquers, automobile finishes, ink, paper, plastics, and other products.

Reichhold Chemicals, Inc. has merged completely with Watson-Park Co., Ballardvale, Mass., which has been an affiliate of Reichhold's

Fiberglas* Overlay Mats provide new design flexibility



H. J. Heinz wanted a smooth finish on their dispenser rack molded by G. B. Lewis Company. Koch of San Francisco wanted their luggage to have the jack-straw finish. Fiberglas mats now give the molders the flexibility of design needed to satisfy both.

Owens-Corning Fiberglas overlay mats now make possible compiete freedom of design—your choice of textured or smooth surfaces on both flat and curved parts. These lightly bonded Fiberglas overlay mats are already being used successfully by automobile and appliance parts molders to match the finish of buffed and painted steel where desired. These new overlay mats are gossamer-thin —available in both 15-mil and 30-mil thicknesses. When inserted as the surface layer in layups, the 15-mil mat draws deeply into the most sharply curved parts, while the 30-mil mat gives the smoothest surfaces possible on more limited contours. And *both* mats are silane-treated for maximum wet strength. So choose from these mats that give you the greatest flexibility . . . that offer both smooth and textured finishes on both flat and curved surfaces. Choose Fiberglas mats. For answers to your questions about FRP—Fiberglas Reinforced Plastics—please write:

OWENS-CORNING FIBERGLAS CORPORATION
Plastics Reinforcement Div., 598 Madison Ave., New York 22, N. Y.

leading a great new industry forward . . .

**Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.*

OWENS-CORNING
FIBERGLAS

THE PLASTISCOPE

sinve 1952. The Ballardvale plant is now the headquarters of Reichhold's New England Div. The new move involves about one million dollars.

The plant at present produces resins for the paper industry, formaldehyde, and textile resins and chemicals. Its output will be expanded in the near future to include urea and phenolic adhesives, and resins for the paint, foundry, grinding wheel, and plastics fabricating industries.

Ralph T. Urich is general manager of the New England Div. **H. F. Shepard**, formerly president of Watson-Park, will continue with the company in an executive capacity.

Nosco Plastics, Inc. has moved into its new plant at 1701 Gaskell Ave., Erie, Pa. A former Read Standard Corp. factory, the new home of Nosco covers over 28 acres of land.

The new plant will enable the company to expand the facilities of its custom molding division, as well as the production facilities of its toy and proprietary lines.

Beginning in 1936 with a 2-oz. press, Nosco has enjoyed rapid growth and today has presses in all sizes from 2-oz. to 60-oz. capacity. Until the recent move, it was necessary for Nosco to house its operations in three different locations.

Delaware Chemicals, Inc., Staten Island, N. Y., and Wilmington, Del., has purchased a substantial portion of stock in **Synvar Corp.** and **Synvar Southern Corp.** Delaware Chemicals, manufacturer of pentaerythritol and other chemicals used in the paint, varnish, and lacquer industries, originally began operations at Wilmington in 1946 and subsequently transferred its manufacturing facilities to the Staten Island plant.

Synvar Corp., Wilmington, manufactures complete lines of urea and phenolic resins and phenolic molding compounds. For the past 13 years, Synvar has been engaged in the production and development of synthetic resins for use in the plywood, rubber, electrical, automotive, and other manufacturing industries. The company recently announced the development of two new phenolic resins for the manufacture of oil filters and for the intermediate adhesion of polyethylene to other materials.

S. C. Cohen, secretary of Delaware Chemicals, states that the planned expansion program to increase production at the Staten Island plant has been completed at an approximate cost of $150,000 and that the plant is operating at full capacity. However, because of the purchase of the Synvar stock, construction of the new plant in northern New Jersey, authorized last year at an estimated cost of $1 million, will be delayed until plans for the companies have been better coordinated.

Consoweld, Inc., a new company formed as the result of an agreement between **Consolidated Water Power & Paper Co.**, Wisconsin Rapids, Wis., and **The Arborite Co., Ltd.**, Montreal, Canada, announces that its $2 million plastics laminating plant at Wisconsin Rapids is expected to be ready for the first equipment installation in June.

The new company will manufacture high-pressure decorative melamine plastics for vertical and horizontal surfacing.

Tupper Corp. has purchased the Blackstone Cotton Mill in North Smithfield, Mass., and will convert it into a plant for the manufacture of polyethylene molded products. The plant contains nearly 400,000 sq. ft. of floor space with 200 acres of land included in the transaction. It will be furnished with new equipment and ready for production of Tupperware by mid-summer. Some 500 or more employees will be engaged. Tupper now has enough floor area in Massachusetts and Rhode Island to make a production floor 60 ft. wide and over two miles long.

The company has plants and offices in Farnumsville and Fisherville, Mass.; Orlando, Fla.; New York, N. Y.; and Montreal, Que. The new operation will not replace any existing units. The Tupper firm, through the Tupper Home Parties, Inc., selling organization, has become a multi-million dollar operation, with 1953 sales tripling those of the previous years. Estimated retail sales value of finished goods for 1954 is $25 million. Not a single item is sold over the retail counter but through 8000 Tupper Home Party plan dealers. The reason given for this type of merchandising is that their dishware cannot be appreciated sufficiently unless its wide range of uses and applications is demonstrated to the prospective purchaser.

COMPANY NOTES

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., announces the following promotions in its Sales Dept.: **Robert U. Haslanger**, formerly of the Texas City, Texas, plant, has been named director of sales for raw materials, including monomers and formalin; **Chester L. Jones**, director of sales for coatings and adhesives; and **Edwin L. Hobson**, director of sales for plastics products. The directors of sales will report to **R. C. Evans**, who has been promoted from general manager of sales to director of marketing. His function will continue to include the over-all supervision of advertising, promotion, technical service, and product development, as well as direct line of sales. **David S. Plumb** has become assistant director of sales for Opalon resins and compounds, industrial resins, and polyethylene; **Theodore S. Lawton** will direct sales for Vuepak sheets, Ultron film, Lustrex, and Resinox; and **Stanley L. King** is now assistant director of sales in charge of Saflex products.

The Plastics Div. also announces that **James P. Skehan**, former district sales manager of the New York office, has been appointed to the newly created post of director of field operations. **Carl T. King** has been named manager of overseas plastics manufacture and assistant to the general manager; **Max O. Debacher** has become assistant manager of overseas plastics manufacture.

Milprint, Inc., 4200 N. Holton St., Milwaukee 1, Wis., has appointed **Joseph O'Brien** sales supervisor of the company's New England division.

F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa., announces that **Alan A. Hutchings**, formerly sales manager of the company, has been elected to the newly

AMPACET*

virgin cellulose acetate
virgin polystyrene special effects

pearl for wall tile, buttons, clock and radio housings, handbags, cosmetic packaging, housewares and hundreds of items.

stardust tinsels for sunglass frames, buttons, handbags, packaging, and novelties of all kinds. Available in both Cellulose Acetate and Polystyrene, it is compounded from imported metallic tinsel of exceptionally large size and brilliant sparkle. Not harmful in any way to equipment or molds.

Ampacet Pearl and Stardust Tinsel Molding Powders are the best available — yet at down to earth prices.

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AMERICAN MOLDING POWDER
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you
work
with
plastics
you
should
work
with
us . . .

PLASTICS SCRAP

and

virgin plastics materials

BOUGHT · SOLD · REPROCESSED

Want to sell plastics scrap? *We need it!*

Want to buy reprocessed plastics materials? *We guarantee quality.*

Want your materials reprocessed? Compounded? Colored? *We are equipped to serve your needs.*

- *CELLULOSE ACETATE*
- *BUTYRATE*
- *POLYSTYRENE*
- *POLYETHYLENE*
- *METHYL METHACRYLATE*
- *VINYL*
- *ETHYL CELLULOSE*
- *NYLON*

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PLASTICS MATERIALS

703 BEDFORD AVENUE, BROOKLYN 6, N. Y.

Phone: MAin 5-7450

Cable: CHEMPROD BROOKLYN

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created position of vice president in charge of sales. Mr. Hutchings joined the organization in 1940 as a sales engineer, specializing in plastics molding equipment.

The Atlas Mineral Products Co., Mertztown, Pa., has named **Dr. Raymond B. Seymour** as its president. Dr. Seymour, originator of furan cement and many other Atlas products, joined the company in 1939 as chief chemist. **Joseph A. Snook** will continue to serve as vice president in charge of sales and engineering.

Rippolite Plastic Products, 2950 Winona Ave., Burbank, Calif., has purchased the **Plastic Products Div. of Alexander H. Kerr & Co.** and will operate under the name of **Rippolite Plastic Products, Inc.** at 3910 Cohasset St., Burbank.

The Watson-Stillman Co., Div. of H. K. Porter Co., Inc., Roselle, N. J., announces the appointment of **H. E. Elliott** as sales manager and **R. W. Schreck** as assistant sales manager of plastics machinery sales.

Romar Plastics, Inc., 1311 E. Main St., St. Charles, Ill., has made the following appointments: **Anthony J. Czarnecki** has been named sales manager; **Emory J. Potts,** chief engineer; and **George E. Hart,** purchasing agent.

G. Felsenthal & Sons, Inc. announces the election of **James H. Moses** as vice president and director of the company. Felsenthal's manufacturing operations were recently moved to its new plant at 3500 N. Kedzie Ave., Chicago, Ill.

Bakelite Co., a Div. of Union Carbide and Carbon Corp., 260 Madison Ave., New York 16, N. Y., has appointed **R. H. Bruce** and **J. M. Herbert** respectively to the newly created posts of Eastern zone manager and Midwestern zone manager of the Molding Materials Div.

The Dow Chemical Co., Midland, Mich., announces that its Strosacker's Research Dept. has been renamed the Polychemicals Research Dept. and the following promotions have been made: **C. C. Kennedy** has been named manager of the research groups comprising the department; **Earl Morris** and **O. R. McIntire** have been appointed director and assistant director, respectively; and **C. E. Lowry** is now director of the plastics basic research laboratory, which is a part of the Polychemicals Research Dept.

Dow also announces that its New York sales office is now located at 45 Rockefeller Plaza, New York 20, N. Y.

Vacuum Forming Corp., producer of vacuum forming machines, is moving into a new plant located on S. Bayles Ave., Port Washington, N. Y.

Vulcanized Rubber and Plastics Co., Inc., 261 Fifth Ave., New York 16, N. Y., announces that **Robert G. Werner** has been appointed general manager of the company and **David Lewis,** director of sales.

Process Mold Co. has moved its office and plant to 19665 Schoenherr Ave., Detroit 5, Mich.

A. Bamberger Corp. and its affiliate, **American Molding Powder & Chemical Co.,** 703 Bedford Ave., Brooklyn 6, N. Y., announces the election of **Walter E. Hirtz** as executive vice president and **Herbert H. Goldmark, Arthur L. Metzger,** and **Matthew T. Staszak** as vice presidents.

Polyken Products, Dept. of the Kendall Co., 222 W. Adams St., Chicago 6, Ill., announces the following appointments: **W. J. Hodges,** 1010 Arbor Ave., Wheaton, Ill., has been named field sales manager; **Paul P. Sikorski,** 215 W. Quincy St., Riverside, Ill., is now staff assistant to the general manager, **G. C. Stineback;** and **N. K. Rankin,** 1344 S. Maple Ave., Berwyn, Ill., former Western district field salesman and Central district manager, has become district manager of the combined districts.

Plexolite Distributing Co., Inc., Los Angeles, Calif., announces the appointment of **Alex Zakerian** as regional sales manager for Southern California. **Leon Feldman** retains the position of general sales manager in charge of national sales. This move is a step in the expansion of plant facilities at El Segundo, Calif., where fibrous glass reinforced structural panels are produced.

Resin Industries, Santa Barbara, Calif., has appointed **Robert W. Marshall,** 6106 Excelsior Blvd., Minneapolis 16, Minn., and **LeeMark Associates,** 706 E. 73rd St., Kansas City 14, Mo., as its exclusive factory representatives.

Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y., reports that **F. E. Caddy,** plant manager at Martinez, Calif., has become manager of the company's new plant at Norco, La. **C. H. Plomteaux** of Shell's Manufacturing Operations Dept. at the head office, will be assistant superintendent of the Norco plant.

The Norco plant will produce allyl chloride and chlorohydrins. Its output will be used to increase Shell's glycerine production by more than 25 million lb. a year and to make available substantial additional quantities of epichlorohydrin and Epon resins.

Canadian Resins & Chemicals, Ltd. has named **John C. Hamilton** general superintendent of the company's plants in Shawinigan Falls, Quebec. Mr. Hamilton, affiliated with the organization for 10 years, replaces **W. C. Heidenreich,** works manager of Canadian Resins' plants, who has resigned to rejoin **Carbide and Carbon Chemicals Co.** in the United States.

United States Plywood Corp., 55 W. 44th St., New York 36, N. Y., has appointed **Studner & Blumenthal Co.,** 920 Broadway, New York, N. Y., exclusive distributors of Kalistron and Kal-tex in the luggage field.

Process Engineering & Machine Co., Inc. has opened a factory and offices at 701 Spring St., Elizabeth 4, N. J. Under its registered trademark, Pemco, the company will manufacture, on either a designed or fabricated basis, process equipment such as condensers, columns, heat exchangers, mixers, and tanks, and plants for production of alkyd, phenolic, urea, and furfural-formaldehyde resins.

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., has appointed **Kenneth K. Danton** manager of its Azusa, Calif.,

Non-Bleeding... Lightfast

Pigment Scarlet Z

20-9100

PIGMENT SCARLET Z works well alone or in combinations to produce non-bleeding lightfast shades in plasticized articles. Combined with Cyanamid's Ultramarine Blue ZFM or Phthalocyanine Blue ZR, it produces a range of beautiful maroons and bright violets.

PIGMENT SCARLET Z is widely used in polystyrene articles such as toys, houseware bowls, dust pans, and clothespins. In polyvinyls it gives color appeal to clothes bags, tablecloths, window draperies, bedspreads, furniture upholstery, shower curtains, and similar products.

Cyanamid Pigments for Plastics

Ultramarine Blues
Cadmium Reds and Yellows
Chrome Yellows, Oranges and Greens
Phthalocyanine Blues and Greens
Iron Blues
Organic Toners and Lakes

UNITANE® Titanium Dioxide
(Anatase and Rutile Types)

AMERICAN Cyanamid COMPANY
PIGMENTS DIVISION
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
BRANCH OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

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plant. He was formerly general production superintendent of the company's Bridgeville, Pa., plant. The Azusa plant produces surface coating resins, polyester resins, molding compounds, laminating resins, and many other products.

Wallace & Tiernan, Inc., 25 Main St., Belleville, N. J., which recently merged with **Novadel-Agene Corp.,** Buffalo, N. Y., announces the election of the following officers: **F. G. Merckel,** president; **R. M. Jackson,** executive vice president and treasurer; and **G. D. Peet,** vice president in charge of product engineering and development. Mr. Merckel has been with Wallace & Tiernan in various executive and sales capacities for about 35 years. For the past two years he has been president of W. C. Hardesty Co., Inc., a subsidiary of Wallace & Tiernan. Mr. Jackson has been associated with the organization for over 20 years and Mr. Peet, almost since its inception.

Conforming Matrix Corp. has opened a West Coast office at 38 La Porte St., Arcadia, Calif. **Jack M. Nims** has been appointed manager of the new office. He will be in charge of sales and field engineering of the Conforming Matrix electro-formed metal spray painting masks and air-operated fixtures.

Chemical Products Corp., King Philip Rd., East Providence, R. I., has opened a new West Coast sales office and warehouse at 1119 W. 36th St., Los Angeles, Calif. All sales and services of the company's Chem-O-Sol plastisol formulation, as well as lacquers and decorative finishes for plastics in the West Coast area, will be handled by **A. J. Caron.**

Acheson Industries, Inc., 420 Lexington Ave., New York 17, N. Y., has named **Raymond Szymanowitz** executive vice president. At the same time, **Acheson Dispersed Pigments Co.,** Ontario & Janney St., Philadelphia, Pa., an affiliate of the above company, announces that **Howard A. Acheson** has been elected president of the pigments company. **A. H. Gere,** former president, has retired from active management but will remain on the board of directors. **John S. Thome,** formerly assistant manager, has been appointed vice president and general manager.

General Electric Co., Pittsfield, Mass., announces the following appointments in the phenolic products plant of its Chemical Materials Dept.: **Samuel N. Johnson** has been named project engineer; **Henry J. Digeser,** process engineer; and **Boyette Edwards, Jr.,** supervisor of industrial engineering.

G-E's Silicone Products Dept. at Waterford, N. Y., has appointed **William S. Kather** supervisor of water-repellent sales development and **Milton C. Lauenstein** supervisor of rubber fabricating industry sales development.

The Chemical Materials Dept. at Anaheim, Calif., has appointed **Harry S. Komer** plant superintendent.

Allied Products Engineering Corp. is now located at 1225 E. Grand Ave., El Segundo, Calif. The company distributes fibrous glass, resins, Styrofoam, and various accessories to these products. In addition to its distribution operations at the new and larger plant, the company will undertake the lamination and shaping of Strux and Styrofoam for the ultimate users of these core materials.

J. Weber Mfg. Corp., 2 E. 54th St., New York, N. Y., has been recently formed as weavers of fibrous glass for the electrical, reinforced plastics, boating, and decorative fields.

Koppers Co., Inc., Pittsburgh 19, Pa., announces the following promotions: **W. J. Reagan** has been promoted to assistant plant manager of production at the company's Kobuta plant at Monaca, Pa. He succeeds **Frank R. Garner,** who is now manager of the plant. **Arden A. Cambre** replaces Mr. Reagan as personnel manager.

Nordan Plastics Corp., 101 Richardson St., Brooklyn, N. Y., has added a complete vacuum-forming department to its finishing facilities, which include manufacturing assembling, finishing, and shipping operations. **T. G. Johansen,** president, states that the new equipment will enable the company to form parts with area dimensions up to 30 by 60 inches.

PERSONAL

James Simpson has been named director of plastic color service of **Ferro Corp.'s Color Div.,** 4150 E. 56th St., Cleveland 5, Ohio.

J. Stanley Bowen has joined **Lunn Laminates, Inc.,** Huntington Station, N. Y., as research and application engineer.

George F. Loomis has been appointed sales representative of **Shaw Insulator Co.,** Irvington 11, N. J. Mr. Loomis will make his headquarters at 57 N. Main St., Waterbury, Conn., and will service the New England Territory.

Charles G. Strowe has been named sales engineer of **Blaw-Knox Co.'s Chemical Plants Div.,** Farmers Bank Bldg., Pittsburgh 19, Pa.

Lawrence F. Larkin is now sales manager of **Plastics, Laminates & Fabrics, Inc.,** 4640 W. Fullerton Ave., Chicago 39, Ill.

Lawrence H. Holden, Jr. has been assigned to the Cleveland district office as plasticizer sales representative of **Pittsburgh Coke & Chemical Co.,** 1905 Grant Bldg., Pittsburgh 19, Pa.

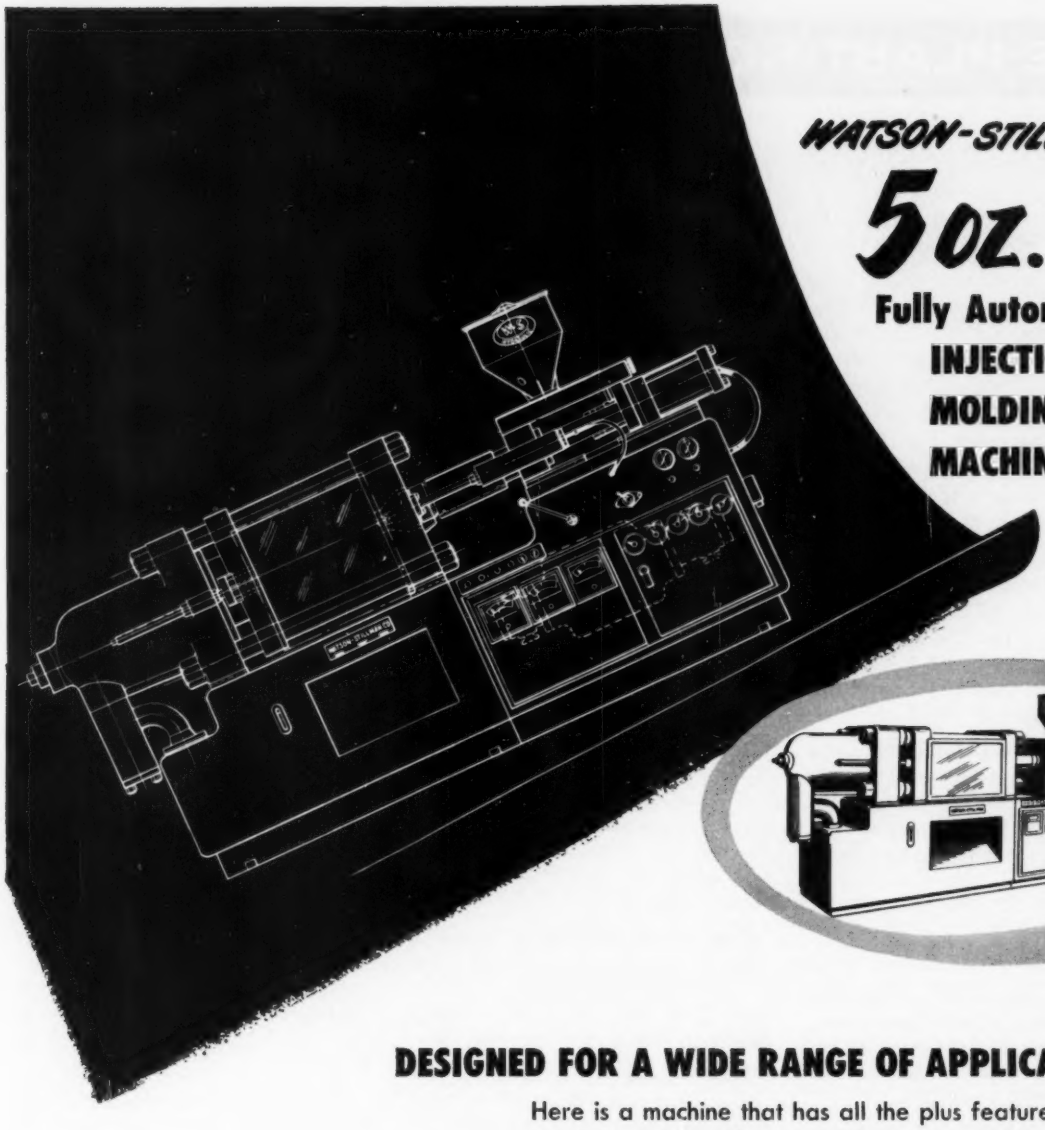
E. F. Abbott has been named general manager of **Victory Mfg. Co.,** 1722 W. Arcade Pl., Chicago 12, Ill.

Paul Fina has been appointed director of sales of **The Fiberite Corp.,** 330 S. Wells St., Chicago, Ill.

William C. Jenner has joined the engineering staff of **Houghton Laboratories, Inc.,** Olean, N. Y., as chief electrical engineer. Mr. Jenner was formerly with Reliance Electric & Engineering Co., Cleveland, Ohio.

Thomas J. LaBounty has joined **Logo, Inc.,** 13799 South Avenue O, Chicago 33, Ill., and will be engaged in market analysis and market development. Mr. LaBounty was formerly sales manager and vice president of Multiplastics, Inc.

Clarence E. Avery, Jr. is now assistant sales manager of **Brosites Machine Co., Inc.** and **Brosites Prod-**



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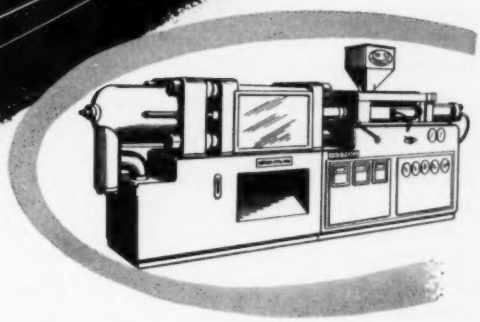
Fully Automatic
INJECTION
MOLDING
MACHINE



DESIGNED FOR A WIDE RANGE OF APPLICATIONS!

Here is a machine that has all the plus features you need for top production and quality control.

- **Internally Heated Torpedo**
- **Large Die Space**
- **Low Pressure Closing**
- **Shoots 5 ounces of Styrene without stuffing.**

Write today for full information!

W-S HYDRAULIC

See the new 5-Oz. in operation at the Plastics Exposition, Booth 723 June 7—10

THE WATSON-STILLMAN COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

150 Aldene Rd., Roselle, New Jersey

DESIGNERS AND MANUFACTURERS OF A "COMPLETELINE" OF PLASTICS MOLDING MACHINERY.

THE PLASTISCOPE

ucts Corp., 50 Church St., New York 7, N. Y. Mr. Avery was formerly affiliated with Patterson Foundry & Machine Co. and The Pfaudler Co.

Richard B. Almy is now advertising manager of **Colt's Mfg. Co.**, Hartford, Conn. He will handle the advertising and sales promotion of the company's Plastics, Arms, Autosan, and Packaging Machinery Divs.

S. E. (Sandy) Glick has resigned from Monsanto Chemical Co. and is now associated with **Knickerbocker Plastics Co.**, North Hollywood, Calif.

Royden C. Rinker has been appointed technical director of the coated abrasives plant of **Armour & Co.**, Alliance, Ohio. Mr. Rinker was formerly associated with Carborundum Co., Koppers Co., Inc., and the National Bureau of Standards.

Dr. R. Stephen Jane, formerly vice president and director in charge of research of **Shawinigan Chemicals, Ltd.**, 600 Dorchester St. W., Montreal, Quebec, has been appointed executive vice president of the company. Dr. Jane succeeds H. S. Reid, executive vice president since 1951, who has retired.

William G. Bacon is now general sales manager of **Gits Molding Corp.**, 4600 W. Huron St., Chicago, Ill. He was formerly sales manager of the company's Housewares Div.

Robert R. Tisdall has joined **R. M. Hollingshead Corp.**, Camden, N. J., as supervisor of Cocoon coatings sales. Mr. Tisdall was formerly director of sales of Protective Coatings, Inc., Tampa, Fla.

Augustine R. Marusi, vice president in charge of Eastern operations of **Borden Co.'s Chemical Div.**, 350 Madison Ave., New York, N. Y., has been appointed president of the division. Mr. Marusi will succeed **William F. Leicester** who has been president of the division since 1944. Mr. Leicester will continue as chairman of the division's directing board and as a vice president of the company.

Fifteen years ago, Mr. Marusi started at the Chemical Div.'s research laboratory at Bainbridge, N. Y. From 1947 to 1952, he served as head of the company's Chemical Div. in Brazil, when he was transferred to New York City as a vice president of the division.

Harry O. Walp, Jr., has been transferred to the New England district office of **F. J. Stokes Machine Co.**, Philadelphia, Pa., as senior sales engineer.

Howard Millington has been appointed North-Central district sales manager of industrial chemicals for **Spencer Chemical Co.** in Chicago, Ill. Mr. Millington's promotion is part of an expansion program in connection with Spencer's entry into the polyethylene field.

Carl Bagen, former chief chemist of **Kaye-Tex Mfg. Corp.**, 110 E. 23rd St., New York 10, N. Y., has been promoted to manager of the company's Technical Sales Div.

Thomas Zawadski has been named sales representative of **Firestone Plastics Co.'s Chemical Sales Div.**, Pottstown, Pa., for the wire and cable industry.

Lawrence E. Stanton has been appointed technical service representative of **Marbon Corp.**, 1926 W. Tenth Ave., Gary Ind., and will cover the Southern states.

David Garrison, formerly on the research and development staff of **Synthane Corp.**, Oaks, Pa., has been assigned to the company's Philadelphia, Pa., district office.

John B. Stobaeus has joined **Lusteroid Container Co., Inc.**, Maplewood, N. J., as secretary-treasurer.

Robert L. Gruen, New York industrial designer and packaging expert, has been elected president of Industrial Designers' Institute.

Harry L. Darby has been named a director and elected vice president in charge of engineering and production of **Winner Mfg. Co., Inc.**, Trenton 3, N. J.

Frank Coffin has been appointed head of a newly created department of **Kennedy Car Liner & Bag Co.**, Shelbyville, Ind. The primary function of the department will be to research and develop new industrial applications of papers, plastics, and foils. Mr. Coffin was previously manager of the company's retail products division.

MEETINGS

March 23—Packaging Association of Canada, Fifth Quebec Regional Conference, Mount Royal Hotel, Montreal, Quebec.

April 3-4—Packaging Machinery Manufacturers Institute, Spring Meeting, Hotel Dennis, Atlantic City, N. J.

April 5-6—Society of the Plastics Industry, Twelfth Annual Conference, Mount Royal Hotel, Montreal, Quebec.

April 5-8—American Management Association, Twenty-third National Packaging Exposition and Conference, Convention Hall, Atlantic City, N. J.

April 14-16—Society for Experimental Stress Analysis, Spring Meeting, Educational Lecture, and Exhibit, Netherlands Plaza Hotel, Cincinnati, Ohio.

April 27—Association of Consulting Chemists and Chemical Engineers, Inc., Symposium and Banquet, Hotel Belmont Plaza, New York, N. Y.

May 16-19—American Institute of Chemical Engineers, Spring National Meeting, Kimball Hotel, Springfield, Mass.

May 17-20—Second Basic Materials Exposition and Conference, International Amphitheatre, Chicago, Ill.

June 7-10—Society of the Plastics Industry, Sixth National Plastics Exposition, Public Auditorium, Cleveland, Ohio.

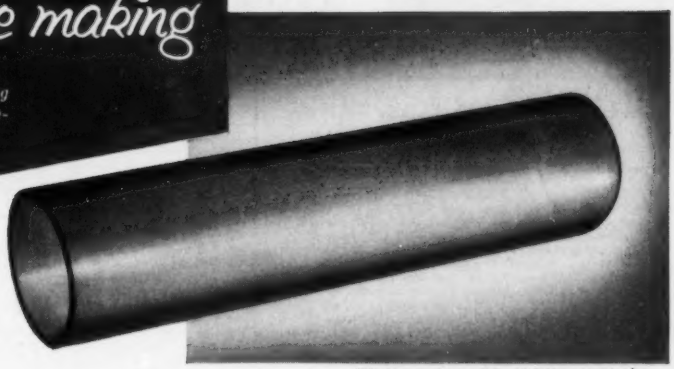
May 14-22, 1955—ACHEMA XI, Chemical Plant and Apparatus Exhibition and Congress, Frankfurt am Main, Germany. Sponsored by Deutsche Gesellschaft für Chemisches Apparatewesen (DECHEMA). Additional information may be obtained from the Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1, Ill.

S.P.E.

April 21—New York Chapter, Hotel Gotham, New York, N. Y.

IDEAS *in the making*

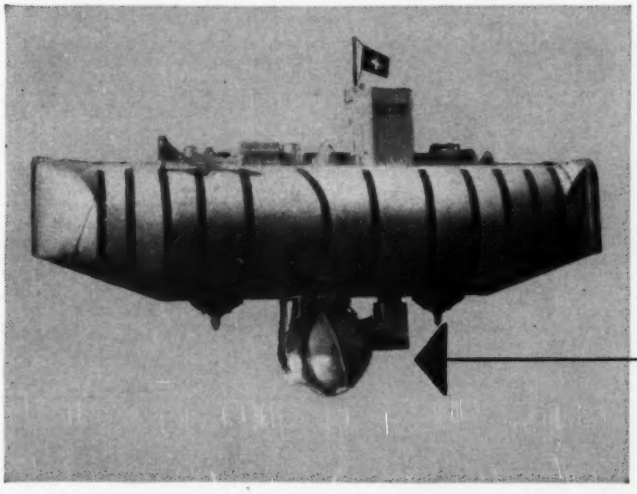
Araldite® Bonding, Casting, Coating and Laminating Resins developed by Ciba Research are simplifying manufacturing methods, improving product efficiency, and opening new fields of product development. You will want to know more about them.



ARALDITE RESINS USED TO MAKE CENTRIFUGAL CAST PIPE WITH EXCEPTIONAL PROPERTIES

(Photo courtesy of Resdel Corporation)

Araldite Resins of the "CN" series are formulated especially for casting, potting, impregnating and encapsulating uses. The pipe shown here is available in a wide range of gauges, diameters and lengths. In addition to exceptional toughness, impact and dielectric strength, it offers excellent resistance to chemical attack from circulating corrosive liquids. Araldite cast pipe of larger diameters with sealed ends is used for storage of chemicals as well. The strong clean pipe is also undergoing tests for supportive structural uses. Araldite Resins of this type achieve outstanding results in castings bonded to metal parts, impregnating of transformers, capacitators, coils, motor windings and other electrical apparatus.



POWER CABLE INSTALLATION PROBLEM SOLVED EFFECTIVELY WITH ARALDITE RESINS IN "BATHYSPHERE" FOR RECORD-SHATTERING DESCENT

On this newest "Bathysphere" the controls are connected by instrument and power cables which pass through the wall of the cabin to the apparatus located outside the cabin. In the previous "Bathysphere" all motors were controlled through relay circuits. The relays were installed outside the cabin and only small wires were able to pass through the walls. By sealing the openings with Araldite Resins it became possible to simplify the arrangement and put full-sized power cables carrying currents up to 200 amperes through the walls. The Araldite Resin used was simply poured into the space between the walls of the sphere and the cables, where it hardened and formed a seal capable of withstanding the tremendous pressure of the water at the great depth of more than 4,000 meters below the surface of the Mediterranean to which the "Bathysphere" recently descended.

SEND THIS COUPON...or write us on your company letterhead... for complete technical data on the physical properties and recommended procedures for the successful use of Araldite Resins for your fabricating needs.

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ARALDITE *Epoxies*

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MP-1

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CLASSIFIED ADVERTISEMENTS

MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

HYDRAULIC PRESSES: 1—Erie Belt Press, 4242 Tons, 2—8" openings, 18'-0" x 52" Steel Steam Platens, 6 rams—30" diam. x 16" stroke. 1—Birdsboro, 2000 Tons, down-acting ram 34" dia. x 14" stroke, 48" DLO, 42" x 42" bed area. 1—Clearing, 500/1500 Tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 393 Tons, 48" x 48" steam platens, 2—15" openings, 4 rams 10" dia. x 24" stroke, approx. 15" per opening. 1—Watson-Stillman, 100 Tons, down-acting ram 11½" x 9½" x 6" stroke, 22" x 20" bed, 24" DLO, self-contained, 15 HP MD Vickers Pump. Unit PRACTICALLY NEW. 1—Watson-Stillman, 100 Tons, 11¾" x 12" platens, 22½" DLO, ram—8" dia. x 15" stroke, complete with 3 HP MD Pump. 1—HPM, 100 Tons, 18" x 18" platen area, ram—8" dia x 18" stroke, 30" DLO, Steel Cylinder—4000 PSI. 2—Burroughs, 75 Tons, down-acting, 17½" x 17" electric-heated platens, 13½" DLO, ram—8" dia. x 10" stroke, complete with 7½ HP MD Oilgear Pump. 1—HPM, 35 Tons, down-acting ram 6" diam. x 6" stroke, 15" DLO, 12" x 6" bed area, self-contained. 1—Induseo Laboratory Press, 12 Tons, Hand Operated, 8" x 8" electrically heated platens. NEW. INJECTION MOLDING MACHINES: 1—Plasticor Vertical 2 oz., Electric Heated, Hand Operated; 1—HPM Horizontal Model 54, 2 oz., 22 Ton Clamp, 12 Ton Injection, Manual Control, Oil Heated. 1—Banbury No. 3A Mixer, with spare rebuilt body, no motor. 1—Thropp 22" x 20" x 60" Mixing Mill, 150 HP Motor and Drive. 1—Thropp 14" x 42", Vertical 2-Roll Sheeting Calender, 15 HP Motor Drive, variable speed. Also: Plastics & Rubber Extruders, Mills, Mixers, Grinders, Injection Molding Machines, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683P Frelinghuysen Avenue, Newark 5, New Jersey. Tel.: Bigelow 8-2500. What have you for sale? What are you looking for?

FOR SALE
One used 16 ounce Lester Injection Molding Machine in good operating condition. Can be seen operating. STANLEY BERG & COMPANY, Frick Building, Pittsburgh, Pennsylvania. Phone Grant 15490.

FOR SALE: 60 ounce Jackson & Church, used 1 week, reasonable. 48 ounce Lester, 1950; 32 ounce Reed-Prentice, new 1950; 24 ounce DeMattia; 22 ounce Impco Vertical; 22 ounce Reed-Prentice, new 1948; 20 ounce Lester; 16 ounce Watson-Stillman, Model 16E-385; 16 ounce Lester, 1946, $10,500. 16 ounce Reed-Prentice, new 1946; 16 ounce H.P.M., 1946, $15,000. 12 ounce Lester w/16 oz. cyl., 1950; 12 ounce Lester; 12 ounce Watson-Stillman, 1953; 10-ounce Reed-Prentice (2), Model 10D, 1950; 8 ounce Leominster, 1945, $4500. 8 ounce Reed-Prentice, 1951; 8 ounce Reed-Prentice, double link, $5000. 8 ounce DeMattia w/12 oz. cyl. 6 ounce Reed-Prentice, $3850. 6 ounce Watson-Stillman, 1942, $2750. 6 ounce Lester, Model 1½L; 4 ounce H.P.M., 1944; 4 ounce Reed-Prentice, new 1945; 4 ounce Lester; 4 ounce Lewis, 1953, $5750. 4 ounce DeMattia, horizontal, $1500. 3 ounce Fellows, new; 2 ounce Fellows, 1951; 25 ton & 50 ton Watson-Stillman angle molding presses; compression presses, 50 ton to 2000 ton, all types; G. E. Dielectric Preheater; vacuum plater 4' cap.; used scrap grinders, ovens; tumbling dry mixers, new, $315. each. ACME MACHINERY MFG. CO., 102 Grove Street, Worcester, Mass.

HYDRAULIC PRESSES rebuilt, repaired. Used presses from laboratory to 1000 tons standard and special, molding and hobbing presses, etc. Used pumping units up to 10,000 p.s.i. all capacities. CLIFTON HYDRAULIC PRESS CO., 291 Alwood Rd. P.O. Box 325, Clifton, New Jersey.

22 Oz. REED PRENTICE Injec. Mold. Mach. 4" Modern Extruder, 565 Ton Hyd. French Oil Press, self contained; Injec. Mold. Machines 1-60 Oz., Compression molding presses 15-750 Ton; Extruders 1¼" to 4½"; Hyd. Pumps—all sizes Grinders 5 to 50 HP, Boilers 10 to 250 HP Ovens—all sizes. Bought & Sold. EVEREADY SUPPLY CO., 805 Housatonic Ave., Bridgeport, Conn. Tel. 4-9471. E. McCallum.

AVAILABLE AT BARGAIN PRICES
Colton 2RP and 3RP Rotary & 4T Tablet Machines. J. H. Day Rotex, Tyler Hummer, Selectro, Robinson, Great Western Sifters. Mikro Bantam, 1SH, 2TH, 3W, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, Double Arm from 12 to 200 gal. Mixers (Unidor and Vacuum also). J. H. Day, from 4 up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day & Robinson Dry Powder Mixers, 100 up to 10,000 lbs. Patterson 25 cu. ft. Double Cone Blender. Package Machy, FA, FA4, Miller, Hayssen, Scandia, Oliver auto. Wrappers. REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements.
UNION STANDARD EQUIPMENT CO.
318-322 Lafayette St., New York 12, N.Y.

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 New R. D. Wood 500 ton EMBOSSING PRESSES: 54"x26" platen: HYDRAULIC PRESSES: 42"x37", 20" ram, 475 tons; 2-7 opening 27"x27", 18" ram, 565 tons; 24"x24" 12" ram, 170 tons; 24"x20" 10" ram, 118 tons; 20"x20" 10" ram, 118 tons; 20"x20" 10" ram, 200 tons; 30"x20" 8" ram, 75 tons; 24"x20" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 15"x15" 8" ram, 75 tons; 2-19"x24" 10" rams, 78 tons; 12"x12" 6½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x 9½" 4½" ram, 20 tons; 16"x16" 3½" rams, 12 tons; PREFORM PRESS: Colton 5½T, Reeves Drive and Motor; LABORATORY PRESSES: Carver & Watson Stillman Units; NEW UNIVERSAL DUAL PUMPING UNITS: 3-15 HP; NEW LABORATORY MILLS, and CALENDERS; EXTRUDER; Modern Plastic 1½"; ACCUMULATOR; HPM 6" ram 2500#, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York 13, N. Y.

FOR SALE: 2 Leominster 8 oz. Injection Molding Machines, 1947, good condition. Rubber and Plastic Equipment. Farrell 16" x 48", 15" x 36" and 6" x 12", 2 roll rubber mills. Other sizes up to 84". New Seco 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. Stokes #280, 4" diam. Preform Machine. HPM 200 ton 30" x 54" ton Platens. 350 ton 22"x24". New Loomis 340 ton, 24"x56" platens. Southwark 325 ton, 42" x 24" platens. Adamson 200 ton. 24" x 24" platens. 200 Brunswick 21" x 21" Platens, 14" Ram, Record Presses. 100 ton 24" x 24". Elmes 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

1 STOKES ROTARY TABLET MACHINE
Model DDS 2
R. GELB & SONS, INC.
Union, N.J. UN 2-4900

FOR SALE: 1—F.B. 32"x92" inverted-L4 Roll Calender, red. drive, d.c. vari-speed motor; 1—F.B. 24"x84" Mill, w.c. bearings, red. drive, 240 HP a.c. motor; 1—National Erie 8"x24" 2 Roll Mill, 10 HP motor; 1—S. B. 8"x16" 3 Roll Calender, 20 HP motor; 1—National Erie 8" Strainer, 75 HP motor; 2—Colton 5½T Preform Presses; 1—Royle No. 4 Extruder, M.D.; 1—F.B. 6"x13" self-contained 3 Roll Calender M.D.; 1—6"x12" Lab. Roller Mill; 1—Reed Prentice 4 oz. Model 10A Injection Molding Machine; 1—No. 1 Banbury Mixer; 7—Dry Mixing Blenders up to 5,000 lbs.; 3—Micro Pulverizers; 2—Ball & Jewell Cutters; 1—Kux Model 50 Preform Machine. Also Grinders, Extruders, Pulverizers, Baker Perkins Mixers, Screens, Kettles, etc. Send us your inquiries. We buy your idle machinery. CONSOLIDATED PRODUCTS CO., INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel. BArclay 7-0600.

FOR SALE—LESTER INJECTION MOLDING MACHINES
One type 2-B-44-6 oz. with 8 oz. injection cylinder, extra large pump. One type 3-S-27-12 oz. with late type Lester internally heated injection cylinder. Both equipped with Ross cooler, Briggs clarifier and heat control instruments. Excellent condition. Can be seen in operation. Immediate delivery.
STERLING PLASTICS CO.
1140 Commerce Avenue, Union, N.J.

STOKES ROTARY PELLET PRESSES (3) 16-punch RD-3 and 15-punch RDS-3. (2) Kux model 25 Presses 21 and 25 punch. Ball & Jewell #1½ stainless steel rotary cutter. Mikro Pulverizers #2-TH, #2-SI. Large stock steel and stainless tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila., 22, Pa.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: Injection Presses: 4 oz., 8 oz., 24 oz. Reeds, 4 oz., 9 oz., 16 oz. HPM. 1 oz. VanDorn. Extruder: 1½" NRM. Scrapgrinders. Ovens. Lab. Presses. Compression Presses: 450 tons, 100 tons. Pumps. Stokes Automatic 50 tons 235 A Press. 42" Slitt. & Rewind. mach. Complete Wire Coating & Drying Unit. 3 HP Gasboilers. Canister Mold. Birdcage Mold. List your surplus equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: POLYVINYL ACETATE UNIT, capacity 1000# per hour. Includes, 500 gal. s/s Reaction Kettle with Condensers and Xpl motor; solid bowl type, all s/s Centrifuge, 30" x 40", m.d.; 3—s/s Tanks, 500 gal., 250 gal.; 3—s/s Pumps with Xpl motors. Equipment is NEW, entirely of 316 stainless. Priced at fraction of new cost. Drawings available. CONSOLIDATED PRODUCTS CO. INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel.: BArclay 7-0600.

FOR SALE
One used 32 ounce Lester Injection Molding Machine in good operating condition. New in 1949. STANLEY BERG & COMPANY, Frick Building, Pittsburgh, Pennsylvania. Phone Grant 15490.

FOR SALE: One 50 ton Stokes No. 235, completely automatic and hydraulic molding machine, complete with motor and instruments, in good condition. Reply Box 1627, Modern Plastics.

FOR SALE: 2 Ball & Jewell Rotary Cutters, 1 HP and 5 HP; 1—10"x20" plastic mill, M.D.; 1—Stokes 200 ton compression press; 1—Lester 12 oz. injection molding machine. Also: cutters, extruders, mixers, etc. CHEMICAL & PROCESS MACHINERY CORP., 146-148 Grand Street, N.Y.C., Tel.: WOrth 4-8130.

FOR SALE: 3-No. 5½ Colton Preform Presses including Reeves variable speed drive. Presses are in excellent operating condition. Can be seen in operation. Deliver: March 1, 1954. Reply Box 1619, Modern Plastics.

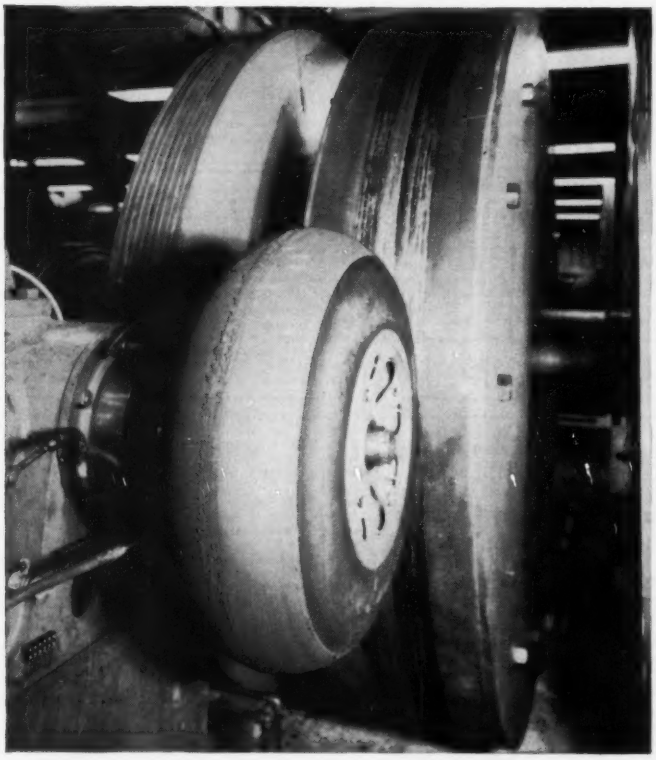
STURTEVANT BLENDER #8 used very little, available for immediate delivery. Price is reasonable. WARREN PLASTICS CORPORATION, Warren, Penna.

FOR SALE: Mayflower, 2KW electronic sealer with 12" by 36" press. Practically new. Manufacturer's guarantee. $1,500. Reply Box 1645, Modern Plastics.

(*Continued on page 256*)

BRAKES FOR —SUPERSONIC-SPEEDERS—

... PRE-TESTED THE WORLD OVER ON ADAMSON UNITED AIRCRAFT BRAKE AND TIRE-TESTING MACHINES



Striking examples of the versatility of Adamson engineering are the Brake and Tire-Testing Machines Adamson builds for the aircraft industry.

Simulating the landing of jet-propelled or other planes of practically any weight, at any given speed, they test the fitness of aircraft brakes and tires for use in actual service. A machine capable of testing the wheels and brakes of a 280-ton, jet-propelled job, landing at speeds above 250 miles an hour, is under construction.

Hydraulics, pneumatics, new and involved instrumentation and unusual control devices including radically new types of brakes for conducting fatigue tests on tires, and for regulating the speed of inertia wheels, are involved. Inertia wheels on some of the larger machines are 16 feet in diameter, weigh 185 tons, rotate at peripherial speeds of 200 miles an hour, and develop 212,000,000 foot-pounds of kinetic energy, yet are so accurately balanced that maximum machine vibration is held within .0005 and .001 of an inch.

As consultants to the U. S. Army Air Force, the U. S. Navy Air Force, the National Advisory Committee for Aeronautics, and to numerous aircraft manufacturers and brake equipment companies throughout the world, we have designed and/or built more machines of this type than all other manufacturers combined.

It may be that brake and tire-testing equipment will never be required in your operation, but keep in mind that Adamson's engineering abilities are available to design and build for you precision machinery not only for the aircraft industry or for the manufacture of rubber or plastics but for whatever may be your purpose.

We invite you to consult us on your next project. You will not be obligated.

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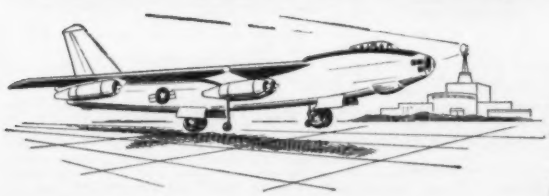
730 Carroll Street, Akron 4, Ohio

Sales Offices In Principal Cities

Subsidiary of United Engineering and Foundry Company
Plants at: Pittsburgh • Vandergrift • New Castle
Youngstown • Canton



Adamson United

AIRCRAFT BRAKE AND TIRE-TESTING MACHINES

(Continued from page 254)

MACHINERY and EQUIPMENT WANTED

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N.Y. Tel.: BArclay 7-0600.

WANTED: Extruder for acetate rods up to 2" diameter. Reply P.O. BOX 175, Bellmore, N.Y.

WANT TO PURCHASE: A Preform Machine Stokes T and R or Colton 345; 350; 5½. Reply Box 1612, Modern Plastics.

WANTED: Embossing Cylinders all types. AMERICAN BUYING SERVICE, 225 W. 34th St., N.Y. 1, N.Y. Tel.: LAckawanna 4-5285.

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N. Y.

MATERIALS FOR SALE

PRINT ROLLS FOR SALE
Copper print rolls, some used, some like new. Fraction of original cost. 15" to 20" circumference by 60" face, ½" to 1" thick copper shells all on "X" taper mandrels. Also some 24" and 48" circumference. Variety of patterns, one to four colors. Also excellent as base cylinders for your new photo or machine engraving, at big savings.
JOSEPH SCHWARTZBACH AND SONS
Eleventh Avenue, Roselle, New Jersey

FOR SALE: 50 drums Tricresyl Phosphate, dark color, otherwise meeting standard specifications @ $0.19/lb; 5 drums Diisooctyl Phthalate @ $0.27/lb; 3500 pounds Ethyl Cellulose N300V @ $0.585/lb; 5000 pounds Lucite HG4 Molding Powder @ $0.51/lb; 1200 pounds Elvanol 32-70 @ $0.5475/lb; 2000 pounds Vinyl Stabilizer C-2 @ $1.49/lb. ACETO CHEMICAL CO., INC., 40-40 Lawrence St., Flushing 54, N. Y. Tel.: INdependence 1-4100.

MANUFACTURER has surplus of ethyl cellulose: 5,700 lbs. virgin, 700 lbs. reground Dow maroon R21 730-2. 1,900 lbs. reground Hercules Red 457JS Color B-42013. Offering the virgin material at .45, reground material at .36. Illitron high frequency dielectric preheater, ½ KW, slightly used. PRODUCT MINIATURE CO., INC., 2249 S. 54th St., Milwaukee 14, Wisc. Phone EVergreen 3-8200.

MATERIALS WANTED

FOR SCRAP AND SURPLUS MATERIALS
Contact
CLAUDE P. BAMBERGER, INC.
132 Centre Street, Brooklyn 31, N.Y.
Tel.: MAin 5-5553
Not connected with any other firm of similar name.

WANTED: PLASTIC SCRAP IN ANY FORM. Rejects—Nozzle Waste—Surplus Inventories, Obsolete Virgin Molding Powders—Acetate, Butyrate, Ethyl Cellulose, Hi Impact, Nylon, Polyethylene, Polystyrene, Vinyl, Acrylic. Highest Prices Paid. We also reclaim your scrap. Consult us for Reprocessing Charges. GERING PRODUCTS, INC., 7th St., Kenilworth, N.J. Cranford 6-2900.

WE ARE ALWAYS IN THE MARKET FOR THERMOPLASTIC SCRAP AND REJECTS OF ALL KINDS. Also surplus or obsolete lots of reprocessed and virgin materials purchased. Highest prices paid. Custom grinding and compounding to your specifications. PLASTIC MATERIALS, INC., 589 Main Street, Westbury, L.I., N.Y. DIAL—WEstbury 7-7124.

RIGID VINYL SCRAP WANTED in large quantities. Printing plate and other not-standard vinyl scrap also acceptable, sheet granule or any other form. We are users and we pay highest prices. No quantity too large. We are willing to sign contract on all your scrap. Reply Box 1610, Modern Plastics.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Ave., Bklyn, N.Y., ES 5-7943.

SCRAP PLASTICS, all forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers, and other plastic and chemical materials. ACETO CHEMICAL CO., INC., 40-40 Lawrence St., Flushing 54, N. Y. Tel.: INdependence 1-4100.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N.Y. Telephone: MAin 5-7450.

MOLDS WANTED

INJECTION MOLDING AND EXTRUDING Company wishes to acquire molds and dies for house-wares, toys and novelties; will buy, rent, or accept on a royalty basis. Submit samples and full details of mold or die, with asking price in first letter. HARSHONE PLASTICS, 600 Lawrence Road, Canton, Ohio.

A SMALL FOREIGN FIRM desires to purchase molds for an injection machine of 4 to 6 oz. to make combs, novelties, dolls, of 2 to 5 inches, etc. Address offers with technical details to COSMOS SHIPPING CO., 8-10 Bridge St., N.Y. 4.

WANT MOLDS to produce refrigerator storage containers, square, round or any other type containers in 10, 12, 14, 16 ounce sizes that can be used as premium packages. Reply Box 1637, Modern Plastics.

GIFTWARE MOLDS—Injection Molds for Gift and Novelty Items. Send Mold Description and Samples to REITS SALES CORP., 485 Lexington Ave., New York 17, N. Y.

MOLDS WANTED: Multiple Cavity Police Whistle mold in good condition. Send complete information, sample of whistle and best price. Other toy molds considered. GEO. S. SCOTT MFG. CO., Wallingford, Conn.

MOLDS WANTED. Toy, Novelty and Housewares Items. Will pay cash for suitable molds. Send samples, mold detail and prices. P. O. BOX 1273, Providence, R.I.

BRUSH MOLDS & BRUSH MACHINERY, injection molds for ladies, men's, military, nail, toothbrushes, etc. Send particulars & samples. Box 382, REALSERVICE, 110 W. 34 St., NYC.

WANTED USED MOLDS for novelties and small toys such as airplanes, automobiles, etc. Molds must be suitable for 2 oz. and 4 oz. machines. Send particulars and, if possible, samples. Reply, Box 1641, Modern Plastics.

PLANTS FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 1605, Modern Plastics.

HELP WANTED

CHEMIST OR CHEMICAL ENGINEER
Experienced in manufacture of vinyl floor tile. Excellent opportunity for personal advancement.
Reply Box 1614, Modern Plastics.

ASSISTANT SALES ADMINISTRATOR for New York City flexible bag and printing plant. Must know markets, have ability to write promotional material, guide field men, and understand the phases of flexographic printing. Write full details. Box 67, REALSERVICE, 110 West 34th St., N.Y.C.

AMBITIOUS MAN, preferably with manufacturing or selling experience in the transparent packaging or vacuum drawing field to join a well-established, fast-growing organization located in the western suburbs of Chicago. Capital investment in the firm required. Reply Box 1629, Modern Plastics.

CHIEF ENGINEER
Excellent opportunity for experienced man with acrylic or reinforced background.
STEINER PLASTICS
Glen Cove, Long Island, New York

PRE-FORM PRODUCTION SUPERINTENDENT—We want a man with a good production background in reinforced plastics. He must have broad experience in the use of pre-form equipment and presses to mass produce fiberglas and resin parts. Administrative and supervisory abilities are essential. PRE-FORM ENGINEER—We want a graduate engineer, who has several years of experience in reinforced plastics employing pre-form techniques. He must be familiar with pre-form laminating procedures and fully qualified to make cost estimates, prepare bids, determine tooling to be used, and to establish production methods. These openings are with a successful nationally known manufacturer who is expanding in the reinforced plastics field. The men we select will be in charge of the development and production of pre-formed proprietary items for a growing market. Our factory is favorably located in the Southeast. We can offer good living and working conditions, a good starting salary, opportunity for advancement. Reply, stating age, education, work history and salary requirements, to Box 1620, Modern Plastics.

PRODUCTION SUPERINTENDENT: Working level man to assume responsibility for plant operations of West Coast processor of industrial plastics. Experience in extrusion and injection molding of Nylon, Kel-F and other materials essential. Excellent opportunity for growth for person capable of conscientious effort. Reply Box 1624, Modern Plastics.

FOREMEN (4). Injection Molding. Top men only. Must be capable of full responsibility for production, quality, maintenance and personnel. Unusual opportunity to join a well integrated and growing, large Chicago molder. Replies also solicited from experienced set-up and maintenance men who know equipment and have supervisory capabilities. Reply in confidence to Company President. Salary open. Reply Box 1601, Modern Plastics.

PLASTICS—Need good man to assume responsibility of full production management of existing good size going extrusion operation of progressive firm located in East. Should be capable of cost reduction mechanization increasing output and have diversified knowledge of techniques of compounding, extrusion of existing compounds including lay flat polyethylene. Future diversification would deem wire coating, vacuum forming piping and other specialties helpful, but not necessary. Degree desirable, but excellent practical man can fill position. Salary dependent upon experience and potentials. Reply Box 1646, Modern Plastics.

VINYL CHEMICAL ENGINEER OR CHEMIST
Experienced on heavy or light gauge calendering. Real opportunity with progressive company.
Reply Box 1603, Modern Plastics.

LOOKING FOR ENGINEER-FOREMAN with plant experience in injection molds, mold design, injection machines and plant operation. Will be given partnership plus salary for running proposed injection molding business in metropolitan NY area. Replies confidential. Send resume to Box 1617, Modern Plastics.

LARGE EASTERN EXTRUDER interested in setting up Plastic Pipe Division completely apart from present operation. Looking for men with Production Know-how and also Sales Engineers. Reply Box 1618, Modern Plastics.

ADMINISTRATIVE ENGINEER—An opening exists with a medium size but growing N.J. manufacturer of industrial rubber and plastic products for an engineering executive to direct and coordinate the efforts of approximately 20 technical employees. The Engineering Department serves the needs of Manufacturing and Sales in the fields of Chemical, Process, and Mold Design Engineering including research and development work. Graduate engineers with background in these areas and some administrative experience are requested to submit resumes to be handled in strict confidence. Reply Box 1642, Modern Plastics.

UREA MOLDING COMPOUNDS AND RESINS
Aggressive medium size plastic producer in Midwest needs man with 3-10 years background in development and production of ureas. Position offers real opportunity in a new division and field of application with this company.
Reply Box 1640, Modern Plastics.

SALES ENGINEERS to represent old-established injection molder. Press capacity 4 to 200 ounces. Tool room, painting, silk screening, hot stamping—all conveyorized. Straightline assembly. Automatic packaging equipment. Prefer experienced men and men with industrial contacts. Also men controlling one or more special deals. Large midwest plant. Give complete details. Personal interview to follow. Reply Box 1600, Modern Plastics.

(Continued on page 258)

Check Cavity Temperatures

Combination and Single Purpose Instruments

In molding plastics, the routine use of the Cambridge Mold Pyrometer will go a long way in preventing off-colors, brittleness, soft centers and low tensile strength. This Pyrometer is an accurate, rugged instrument that instantly indicates the surface temperature of mold cavities.

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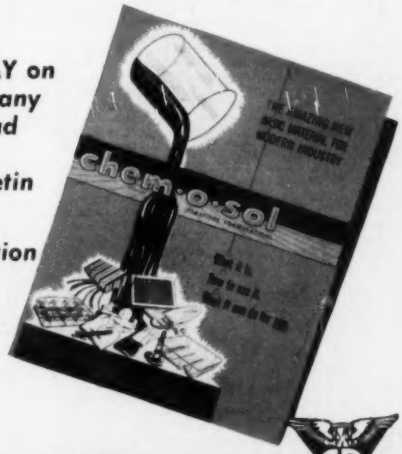

Chemical Products CORPORATION

KING PHILIP ROAD • EAST PROVIDENCE R. I.

(Continued from page 256)

WANT PRODUCTION MAN—Experienced in compression closure manufacturing and who is interested in partnership plus salary for running proposed new plant in NYC area. No capital needed. Confidences respected. Submit complete resume to Box 1616, Modern Plastics.

PRODUCT ENGINEER—Man familiar with P.V.C. molding processes and problems to work in developing industrial product line. Should be engineering trained with knowledge of plastics. Excellent opportunity for growth offered with Trenton, New Jersey manufacturing concern. Please submit full details of background and experience including salary requirement. Reply Box 1643, Modern Plastics.

VINYL COLOR MATCHER
Require man experienced in color matching and production color control in vinyl film and sheeting operation.
Reply Box 1632, Modern Plastics.

TOOLROOM FOREMAN—Must have 10 to 15 years experience on plastic molds. Permanent position. Excellent opportunity for right man. Apply giving experience and salary required to Mr. R. Salusbury, PYNE MOLDING CORPORATION, New Milford, Conn.

CHEMIST—Experienced in coatings for Research on lacquers, hot melts and waxes for Wisconsin Paper Manufacturer. Give training, experience, and salary expected in letter. Reply Box 1621, Modern Plastics.

SUPERVISOR OF DESIGN ENGINEERING—Experienced mold designer with ability to supervise a Design Department is required by a well-established manufacturer of hard rubber and plastic products in Trenton, N.J. Position requires college engineering training plus actual experience in mold design. This is one of the key supervisory jobs in the Engineering Department and can be a permanent position for the right man. Submit complete details of education and experience including salary requirement. Reply Box 1644, Modern Plastics.

SITUATIONS WANTED

PLANT MANAGER OR CHIEF ENGINEER. Plastics Engineer with thorough experience in all phases of Injection Molding, with special emphasis on Estimating, Product Design, Technical Service, Mold Design, Molding, Finishing and Assembly Department Supervision, Quality Control, Packaging, Methods and Incentives. Presently Plant Superintendent in charge of large Molding Plant. Seeking responsible position with progressive organization. Chicago or West Coast location preferred. Reply Box 1626, Modern Plastics.

PLASTICS ENGINEER—Ch.E. Columbia 1937. Nine years extrusion of fluoroethylenes, others; hose, wire, cable covering; reinforced plastics molding, laminating; thermoplastics processing, forming, fabricating; hydraulic equipment. Eight years other fields. Good mechanical, plant, laboratory background. 39, family. Development preferred. North Jersey-metropolitan area. Reply Box 1628, Modern Plastics.

COATING, LAMINATING, EXTRUSION, Impregnation, Gravure Printing, Foil Rolling, Vacuum Metal Evaporation, Rubbers, plastics, thermosets and latex. Aluminum, papers, films and textiles. Defense and commercial. Extreme temperatures. At present chemical director AaA-1 multi-plant company which operates in all these fields. Wish to change; available for two days per week on permanent basis. Development, Production or Marketing. Individual problem, or general supervision or special conditions. Reply Box 1602, Modern Plastics.

SALES AND ADVERTISING EXECUTIVE—Presently employed—past 7 years Sales and Advertising Manager of national concern. Experienced in creation and supervision of national sales force. Prolific on promotional ideas, new product design, packaging. 36, college trained, additional 10 years experience in sales, advertising, merchandising, manufacturing, administration. Good basic knowledge of plastics and hard line merchandise. Excellent references. Reply Box 1634, Modern Plastics.

PLASTICS ENGINEER at present employed by user of plastics in the electrical field, desires to relocate. Capable to assume responsibility in position of liaison, Technical Sales, or Product and Mold design. 9 years experience in Tool design, Product design, Estimating and Methods of Injection, Transfer and Compression molding. Custom molding experience. Age 38. Two yrs. college study in Mechanical Engineering. Reply Box 1607, Modern Plastics.

REPRESENTATIVE now successfully representing extruded plastic manufacturer in Michigan selling to Industry for production and maintenance wishes to represent another manufacturer of plastics not competitive with product now represented. Eighteen years sales experience. Will only consider top quality manufacturer that can meet the exacting standards and cost problems of the Automotive Industry. Reply Box 1615, Modern Plastics.

GENERAL MANAGER of well known injection molding plant desires relocation for personal reasons. Has 15 years experience with well known manufacturers. Complete knowledge of piece part and mold design, estimating, manufacturing, cost analysis, and machinery. Has complete experience as sales engineer with necessary contacts. Well known and with best references throughout entire plastic industry. Will relocate. Reply Box 1636, Modern Plastics.

ENGINEERING SPECIALIST, experienced in all phases of plant management in Plastics, Rubber, and Metal fabrication, desires permanent connection with progressive plastic company. Location immaterial. Background includes 14 years experience in plastic fabricating of aircraft parts, injection molding, extruding, plastisols, and low pressure polyesterglass molding, plant layout, tool and machine design, maintenance, estimating and cost analysis. Reply Box 1631, Modern Plastics.

CHEMICAL ENGINEER with 7 yrs. plastics experience in technical sales, vinyl formulation and extrusion, plant engineering, product development. Married, 30, graduate work, licensed engineer, SPE. Tau Beta Pi. Desires responsible position in sales, development, or manufacturing with material supplier or processor. Reply Box 1639, Modern Plastics.

POSITION WANTED AS Set-up and Press Maintenance Man. 10 years experience with large company on fully automatic compression and transfer presses making Industrial parts such as closures, sockets, wiring devices, etc. Also some experience in Injection Molding. Available on short notice. Location secondary. Capable of assuming position as Foreman of molding dept. Reply Box 1609, Modern Plastics.

EXTRUSION ENGINEER—Chemical Engineering Degree—Production experience in extrusion of polyethylene film, tubing, and custom extrusion of vinyl compounds, elastomeric and semi-rigids, dry blending of vinyl resins. Polyethylene bag making, familiar with printing, embossing and methods of treating film. Have set into production new operations and handled administrative details. Reply Box 1638, Modern Plastics.

VINYL CHEMIST—7 years experience calendered films and sheeting. Formulating, color matching, control and testing, printing, embossing, heat-sealing, and laminating. At present employed by major calendering firm but desire change. Will consider technical sales or service for progressive raw materials supplier. Reply Box 1623, Modern Plastics.

SALES AGENTS WANTED

SALES AGENT WANTED
Prominent, well-known plastics manufacturer in Midwest seeks outstanding sales agent in New York-Philadelphia area for polyester and low pressure phenolic impregnated fiberglass fabrics and mats. Must have previous experience with application of above material. Unusual opportunity. Generous commission basis. Please submit full details. All replies confidential. Reply Box 1606, Modern Plastics.

FIELD REPRESENTATIVES WANTED—Versatile extruder of nylon, KEL-F, vinyl and polyethylene, film and sections, plain and reinforced, and specialty insulated wire, wants capable representatives with suitable background to call on automotive, aircraft, shoe, appliance, electronic and other industries which can utilize these products. Liberal commission arrangement. Write in confidence, giving territory covered and present lines. Reply Box 1622, Modern Plastics.

EXPERIENCED MANUFACTURERS SALES REPRESENTATIVES—Wanted by rapidly expanding Custom Fabricator of Glass Fiber Reinforced Plastic and parts formed of Thermoplastic Sheet Materials. We are interested only in men of proven ability who are now calling on industrial accounts and who are looking for means of increasing their earnings with an added line. Protected territories, open commission basis. Give complete resume in first letter including experience, territory, references, background and a recent snapshot. Reply Box 1625, Modern Plastics.

SALES REPRESENTATIVE wanted by Custom Injection Molding and Plastic Extruding company. Modern plant with up to date facilities, located in mid-west. Desirable territories open—commission basis. Reply giving experience, present lines and territory wanted, to Box 1633, Modern Plastics.

TEFLON—Established organizations of representatives wanted for a few of the major industrial areas to sell DuPont's Teflon and Dixon's Rulon fluorocarbon plastics. Exclusive territory selling for a DuPont selected and a growing Teflon processor. Write DIXON CORPORATION, Bristol, R. I.

EASTERN MANUFACTURER with well equipped compression molding plant is seeking the services of sales representatives to call on industrial and commercial users of reinforced fiberglass moldings—state experience. Reply Box 1630, Modern Plastics.

PLASTIC SCRAP. Representative for Metropolitan New York to sell compounds and buy scrap. Excellent opportunity for experienced, high calibre man. Will make first class financial arrangements. Please reply in detail. Reply Box 1613, Modern Plastics.

SOME TERRITORIES AVAILABLE for aggressive sales reps with experience in plastics, preferably with thermoplastic extrusions. Write ANCHOR PLASTICS CO., INC., 36-36 36th St., L.I.C. 6, N.Y. giving details and references.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Reply Box 1604, Modern Plastics.

UREA MOLDING COMPOUNDS Manufacturer desires additional sales representation. Replies treated in confidence. Opportunity for good earnings. GORDON CHEMICAL CO., A & Lombard Sts., Wilmington, Delaware, Box 547.

SALES AGENT WANTED
Prominent, well-known plastics manufacturer in Midwest seeks outstanding sales agent in Dallas-Kansas City area for polyester and low pressure phenolic impregnated fiberglass fabrics and mats. Must have previous experience with application of above material. Unusual opportunity. Generous commission basis. Please submit full details. All replies confidential. Reply Box 1611, Modern Plastics.

MISCELLANEOUS

OPPORTUNITY FOR PLASTIC Manufacturer or Individual with compression and plunger moulding experience interested in affiliating with well established Canadian plastic manufacturer. Would consider selling an interest to reliable manufacturer or individual. Reply Box 1608, Modern Plastics.

FOLDING BOXES—CLOSEOUTS—25M 5¼x5¼x7¼ — $10M; 18M — 5¼x5¼x16 — $15M; 20M 6—¾x5¼x11½—$13M; 15M 13½x3x13½ $15M; 30M 7x3x9—$12M; 12M 8x2x11—$13M; 23M 12½x8¼x2½—$15M; 30M 3¼x⅝x3¼—$4M; 40M 1x1x3¼—$3M. Many other sizes available for immediate delivery. BERRY BOX COMPANY, INC., 1013 Broadway, Brooklyn, N. Y. Telephone: GLenmore 5-0402-8906.

MANUFACTURE NEEDED—Take on fine promotional item—Colorful Dental—Pak Patented—Plus self filling brush for one operation. Will intrigue you. Investigate—Royalty basis. R. J. BYRUM PRODUCTS, 23-23 University Avenue, Grand Forks, N.D.

MOLDS WANTED for 20 ligne and 22 ligne ring fish eye buttons. Send samples and prices. Also Stokes "B" Tablet press. All must be in first class shape subject to inspection. Will buy surplus urea molding powders. Reply Box 1635, Modern Plastics.

ACETATE—25¢ per lb. standard colors, from stock, F.O.B. New York. PEERLESS CHEMICAL CORP., 110 Bleecker St., NYC.

STRUCTUAL PLASTICS—TESTING—Analyses, Reports, and Recommendations. Prompt Service. W. R. CHANCE & ASSOCIATES—Consultants, Designers, Fabricators, 1715 Lee Highway, Arlington, Va. Tel: JA-8-6847.

PLASTIC INJECTION WORK. 8 valuable molds for religious articles. High profit—Excellent opportunity. Cause illness back to Europe. Reasonable offer accepted. P.O. Box 130 Station H Montreal, Canada.

All classified advertisements payable in advance of publication

Closing date: 28th of the second month, e.g., March 28th for May issue.

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

ZENITH "covers" the "stinger" in the Navy Neptune's tail

The U.S. Navy Neptune—Lockheed's P2V-5—has a new elongated "stinger tail" which encloses even more anti-submarine equipment than standard models carry. These new weapons seek out and localize enemy submarines lurking hundreds of feet beneath the ocean's surface.

The fiberglass reinforced plastic cone enclosing and protecting this highly sensitive and costly electronic equipment is another outstanding example of ZENITH specialization in radome production. For a speedy solution to any production problems in this field, contact Zenith Plastics Co., Gardena, California.

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SOFT PLASTICS

Vinyl Plastisols

The versatility of vinyl dispersion (Plastisol) compounds lend themselves to many wide and varied applications. The Watson-Standard laboratories can help you adapt these products to production and end uses.

Molding:

Watson-Standard Vinyl Plastisols and Rigidsols have been used with both slush molding and dip molding. Such items as doll and doll parts, toys, spark plug covers, electrical components, novelties, puppets, toilet valves, boats, light sockets and others are illustrations of this type of application.

Dipping:

Watson-Standard Vinyl Organosols and Plastisols have been applied by dipping. Varied end products include dishwasher baskets, dish racks and drainers, electrical wiring, gloves, and springs for the automotive and upholstery industries.

Spreading:

Watson-Standard Vinyl Plastisols and Organosols may be spread coated. Coated textiles and paper are typical of this type of application.

Spraying:

Special foundations of Watson-Standard Vinyl Organosols and Plastisols may be applied by spraying. Finishes for metal furniture, cabinets and blowers are representative uses.

Casting:

Since Watson-Standard Vinyl Plastisols are in liquid form and may be readily poured, they lend themselves to casting. Casting applications include films, sealants for automotive and refrigeration industries, ceramic pipe joint threads, and potting compounds.

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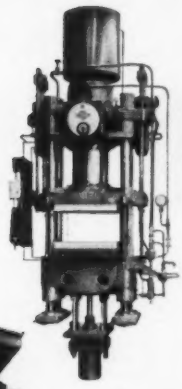

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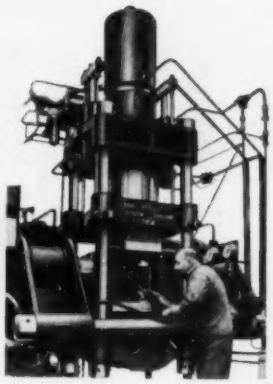

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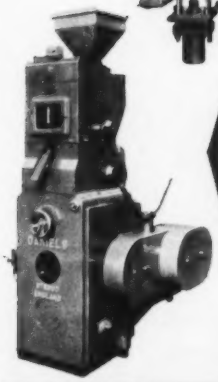

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100% Elastic Modulus (psi)	1500	1600
Shore Hardness (10 sec)	78	78
Low Temp. Flexibility Tf (°C)	—25	—26
Activated Carbon Volatility (24 hrs. @ 90°C.)	9.2%	5.0%

*Note: Formulation
Vinyl Resin 65%
Plasticizer 35%
Ba-Cd Stabilizer 3 phr

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